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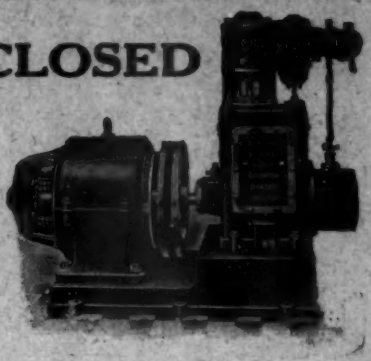

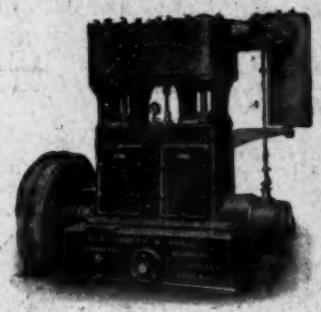

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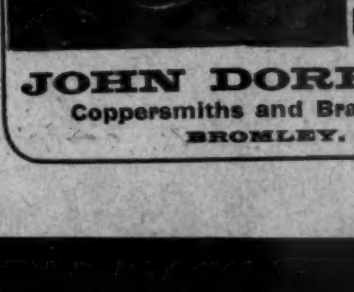

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THE
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THE HACKNEY CASE.

WITH the decision of the Court of Appeal, on Tuesday last week, dismissing the appeal of the Attorney-General "at the relation of the Gas Light and Coke Company," against the judgment of Mr. Justice Astbury, a further stage has been reached in the controversy between the gas interests and the electricity supply industry. Whether the dispute will be carried to the final Court does not appear; as notice of appeal was not given, however, we feel at liberty to comment on the case. To our mind, from the very first the result was a foregone conclusion, and, while we were debarred from expressing our views upon the merits of the case, in our issue of April 20th last we urged the municipal electricity supply authorities to rally to the support of the Hackney Borough Council, which was singled out for attack by the Gas Co., and whose success was of vital importance to all of them that had a power load, believing, as we indicated, that there could be little doubt as to the outcome.

As in previous cases, the matter turned upon the question of preferential treatment of a certain class of consumers by the supply authority. To us, who are not lawyers, it is difficult to understand how any such action could be expected to succeed, seeing that the Act distinctly states that undue preference must not be shown to any consumer in comparison with any other consumer under similar circumstances. Now, consumers of electrical energy for lighting are not consumers "under similar circumstances" to those who take energy for power only; the gas companies admit that this is true, and in some cases they themselves make different rates for lighting and for power. Again, consumers of energy both for lighting and for power form a third class, and each of these classes is capable of indefinite sub-division, from the point of view of their effect upon the working and finances of the supply undertaking. So long as *the same terms are offered to every consumer in a given class*, we fail to see how the terms of the Act are infringed, and there never has been any suggestion that such was not the case at Hackney or elsewhere under the type of tariff in question.

What the Gas Co. really claimed was that one *class* of consumers was preferred over another—that the user of light only was charged at a higher rate than the user of both power and light, so far as the lighting portion of his consumption was concerned; but the Act says nothing about preferential treatment of a whole class of consumers, and a class may comprise any number of consumers from one upwards without undue preference, if the same tariff is offered to all who choose to place themselves in

that class. Thus, a special rate might be offered to all electrochemical works which came on the mains; there might be only one such works in the district—but at any time others might be established, and would be entitled to the same terms, under similar circumstances.

The law, however, appears to require that preference shall not be shown to a class of consumers, but that where more favourable terms are granted to one class than another, it must be capable of demonstration that the former are the more advantageous consumers to the supply undertaking. The Gas Co. contended that an intermediate scale should be provided for customers who used both light and power, higher than that offered to power users only, but lower than that offered to users of light only, thus recognising the division into classes, but alleging undue preference as between class and class. But the weakness of their case was effectively demonstrated by Lord Justice Swinfen Eady in his admirably lucid judgment, of which we give a summary elsewhere in this issue. He pointed out that by the working of the maximum-demand system upon which the tariff was based, precisely that result was attained which the Gas Co. desired—namely, that the user of energy for both purposes was charged at a higher rate than he would have had to pay for power only, because the lighting load necessarily worsened his load factor. "The effect," he said, "of the sliding scale is that it does in fact introduce and adjust a third scale for power and light combined, the charge being higher than would have been the charge for power only, and lower than would have been the charge for light only." Hence there was no breach of the Act. Lords Justices Warrington and Scrutton held the same views, and the appeal was dismissed with costs.

Incidentally, we may point out that, following the line of argument of the appellants, a flat rate is one of the worst offenders from the point of view of equity. A one-hour lighting consumer under this tariff is charged at the same rate per unit as a three-hour lighting consumer; but the latter is by far the more profitable to the electricity undertaking. Hence the former, who may even be supplied at a loss, receives undue preference over the latter!

National Works in Germany.

The threat of nationalising the supply branch of the electrical industry in Germany has been hanging over the undertakings now for some years past, and is gradually assuming a material form in directions which were scarcely expected. In the first place, an act which may be regarded as a war measure is the recent acquisition by the Imperial Government of the undertaking of the Electro-Works Co., which furnishes energy to Government works for the fixation of nitrogen, from a lignite fuel generating station in the district of Bitterfeld, the cost of acquisition being put at approximately £2,500,000, as mentioned a short time ago. Secondly, a big scheme is under way in Bavaria for the further utilisation of water powers in connection with the establishment of local industries, and the conversion of Bavarian railways to electric traction. In the third place, the Prussian Government has laid before the Diet an estimate for £650,000 for the erection of a steam-power station near Hanover. This scheme lies in connection with the power station built on the Weser near Bervergen in 1906, and the project settled in 1916 for the utilisation of the upper reaches of the Weser and of the water power of the Main. The object of the Hanover station is to connect these two power stations, and thus form a large and self-contained State area of supply from Bremen to the Main, but the new station is only to be brought into service two years and a half after the conclusion of peace. In Saxony, too, where the Government already owns certain electricity supply works, estimates have just been placed before the Diet for an expenditure of £2,000,000 on extensions and the acquisition of further shares in two companies. It would thus appear that the developments being undertaken by Federal States independently will render it exceedingly difficult for the control of the supply business to be proceeded with, as was originally suggested, on an Imperial basis. At the same time, no one can foresee what results may possibly ensue from the Imperial absorption of the large works in the district of Bitterfeld, and the long-distance line which is now being carried thence to Berlin to assist in coping with the effects of the coal scarcity in the capital.

Electric Cooking.

Elsewhere in this issue we conclude our abstract of the interesting paper on electric cooking read by Mr. W. A. Gillott before the Institution of Electric Engineers. The subject is of particular interest at the moment, as, though domestic electric cooking has necessarily been somewhat in the shade during the war, the latter has apparently brought into greater prominence than might otherwise have been the case the advantages of large-scale or collective electric cooking. One of the features of Mr. Gillott's paper which will interest central-station men is the almost monotonous similarity of the load curves, although both restaurant and staff kitchens are included; the curves, in fact, coincide too well, and this presumably will be a feature of the works cooking load in most industrial centres. The London discussion disclosed the similarity of the load factors of the installations described, which for this class of cooking can apparently be taken at 13 per cent. with a maximum demand of 35 to 55 per cent. of the connected load; attention was also drawn to the obvious necessity, where the charge for energy is based on load factor conditions, of adopting those types of apparatus which favour an off-peak load—this, of course, being possible where electric water heating is employed.

It was noteworthy that the sense of the meeting was almost wholly in favour of placing reliability before heat efficiency; this is a point we have often emphasised, for it is obvious that the consumer must be able to depend on his apparatus, and that, even were the latter highly efficient in the hands of an expert, the average user could not hope to reproduce his results day in and day out. What we may call the "cooking efficiency" of the apparatus must exercise an important influence on its design; a few units more or less are of little consequence, in comparison with ease and certainty of obtaining the desired cooking result. In this connection, the heated surface hob, by reason of the great range of heat intensities which it allows to the cook, would appear to offer considerable advantages over any form of switch-controlled hot-plate, though, of course, this is a matter which practice only can settle.

As there is no question that electrical cooking on a large scale is a desirable enterprise, both to the user and to the central station, it is probable that not so much interest attaches to Mr. Gillott's paper itself as to his concluding remarks on the necessity of forming an energetic and unbiased advisory committee representative of both central-station authorities and manufacturers, in order to promote the business end of what is already a good proposition.

This proposal is, of course, not a new one, and if carried out it would greatly speed-up the commercial development of electric cooking.

COAL STACK FIRE RISKS.

By E. B. PAUSEY.

During the present difficult times, and doubtless for a considerable period after the fighting has ceased, there can be no question but that fuel will occasionally, like many other necessary commodities, be abnormally scarce. On the one hand, shortage of skilled efficient labour, and, on the other, heavy and sudden demands, are conditions that are certain to persist at least during the period of reconstruction, and, in spite of increased economies which may be brought about by the general adoption of scientific systems of boiler-house control in place of the more or less crude methods in operation at the present time, the possibility of shortage due to these conditions will compel those in charge of important power stations to safeguard themselves by providing sufficiently large stocks of fuel to tide over any such temporary periods of scarcity as may be reasonably expected. In this country coal is at present practically the universal fuel, and the provision of a coal stack is the most obvious and most popular means of keeping reserve supplies at hand.

Now, easy though it may be to dump down coal on a stack, bitter experience tells us that care and thought must be used, otherwise serious loss may take place owing to the overheating or, maybe, ignition of the stored fuel. This is a risk which cannot be completely covered by insurance; if the reserve fuel is lost and the regular supplies fail, no amount of money payment will avail to prevent stoppage of the plant, an occurrence whose cost to the community cannot be estimated. Therefore, in asserting, as I do, that the matter is of national importance, I believe that I am not exaggerating its claims, and I hope that a little discussion of the possible causes of the spontaneous ignition of coal and the means whereby the risk thereof can be minimised may not be without interest. I am, of course, quite aware that the subject is not entirely new; there has, indeed, been a large amount of theorising upon it; but I certainly think that a majority of the theories propounded have been built up on hasty generalisations from insufficient evidence.

For instance, there is the question whether sulphur is responsible for the spontaneous ignition of coal. Many people whose opinions are well worthy of consideration will answer this question decidedly in the affirmative, while others, equally worthy of consideration, will give just as emphatic a negative. Both parties claim to speak in the light of experience, yet, so far as I am aware, not one has given us any definite reason, or anything but bare assertion or denial, for his belief or unbelief. Now, on the one hand, the oxidisation of sulphur is not, at ordinary temperatures, such a very vigorous action, nor does it evolve nearly so much heat as that of carbon or hydrogen, and at the same time sulphur only forms a small proportion—say about 1 per cent.—of coal, so that apparently it can have but little heating effect in any case. On the other hand, an efflorescence of what appears to be sulphur is a frequent sign of fire in a coal stack or large ash heap; at the same time, this is not evidence that the sulphur is responsible for the outbreak. It is quite possibly due to the dissociation by heat of sulphur compounds, with the result that on arrival at the cool exterior of the stack the sulphur vapour becomes condensed and appears as flowers of sulphur, being thus not a cause but an effect of the internal heat of the stack.

It is, however, quite possible that sulphur, either in the free state or in combination with other elements, may so enormously accelerate the oxidisation of the carbon or hydrogen in the coal by catalytic action as to be an indirect cause of the overheating. In any case, I think there can be little doubt that the overheating is at least started by catalytic action of some kind.

While catalysis is a well-known and familiar phenomenon, it may be as well, in order to emphasise its importance and the great probability that it is largely responsible for coal stack fires, to illustrate it by a description of the catalytic effect of platinum on a mixture of hydrogen and oxygen. It is a matter of common knowledge that if a mixture of these two gases be kept at an ordinary temperature no apparent combination will take place between them, no matter how long they are kept; but that if a lighted taper be introduced the two gases immediately combine explosively, forming water and liberating considerable heat. Why, it may be asked, should the introduction of the light have such an effect? The unthinking "man-who-knows-it-all" will say: "Why, because you have set light to it, of course!" and put you down as a fool for asking such a question. But it pays sometimes to ask obvious questions, and to give consideration to what are generally accepted unquestioningly as every-day facts.

In the present instance, what happens is that the portion of gaseous mixture immediately adjacent to the flame becomes heated so much that combination takes place, developing so much heat that the next portion of gas is sufficiently heated to combine, the effect being that a flame suddenly flashes through the mixture, and the combination of the whole is completed almost instantaneously. If the experiment be repeated with finely divided platinum in place of the lighted taper, practically the same result occurs, the cold platinum having the same effect as the hot flame of the taper. Moreover, if the mixture of gases be pure the platinum can be used over and over again indefinitely, showing that it does not enter into combination itself, but that its presence is sufficient to accelerate enormously the chemical action. This is the phenomenon known as catalysis.

To get an idea of what this catalytic action means, it should be borne in mind that the chemical combination of hydrogen and oxygen although it does take place at ordinary temperatures, is then vanishingly slow, the relation between the time taken for the action to proceed to completion, and the temperature of the mixed gases being such that for every 18° F. increase of temperature the speed of the action is approximately doubled. If, therefore, a mixture of the two gases in a certain vessel would completely combine in the thousandth part of a second when at a temperature of 2,000° F., a fairly simple calculation will soon show that a period of many millions of billions of years would have to elapse before the action could proceed to completion if the temperature were maintained constant at 60°. Yet this awful abyss of time, long enough, conceivably, to cover the whole life of the Solar system from the almost infinitely distant period when the primordial nebula began to condense right along to that other far-off time when the sun, its last spark of fire vanished, shall be no more than a huge mass of clinker, may be shortened to a fraction of a second merely by the application of a little platinum, which need not even be hot!

Catalysis may be, therefore, a prodigiously powerful factor in increasing the speed of an action. When we consider that though a piece of coal may be kept indefinitely at ordinary temperatures without any apparent change taking place, yet when stored in a stack of large size heating occurs, we are almost forced to believe that the first heating must be due to catalytic action by some substances present in the coal upon the hydrogen or volatile hydrocarbons given off by it—in extremely small proportions at first, but more and more rapidly as the stack heats up.

Another property of catalysts may be noted; it was remarked in connection with the combination of hydrogen and oxygen that if the gases were pure the platinum could be used over and over again indefinitely. If there are certain impurities present, the catalyst will gradually lose its power, becoming, in fact, "poisoned." This is the reason why automatic gas-lighters on the catalytic principle are not a success—they are too short-lived.

A fine field for investigation is thus opened; let some chemist ascertain what are the catalysts which cause spontaneous ignition of coal, and also their appropriate "poisons," then all we shall have to do will be to spray our coal with the latter, and we shall be able to stack it to any depth we please without any fear of danger!

Such an achievement is, however, decidedly a thing of the future, and, in any case, its accomplishment is very problematical; so that at present, when stacking any coal containing more than a small proportion of inflammable volatile matter—a bituminous coal, such as is often used—

all that we can do is to assume that it is dangerous, and act accordingly.

Probably the chief factors regulating the liability of a given coal to fire when stacked are: the amount of free hydrogen, or methane, or other hydrocarbons given off by it at ordinary temperatures; smallness of size and consequent increased surface from which such volatile bodies may be disengaged; the possibility of a sufficient supply—and no more than a sufficient supply—of oxygen to its interior; and insufficient means of dissipating any heat generated. A bituminous slack, especially a "nutty" slack made up of particles of all sizes up to, say, 1½ in. or 2 in. cube—such a coal as is commonly used for burning on mechanical stokers and, consequently, for storage in stacks—fulfils the first three of these conditions to a greater degree than any other class of coal, and a fuel of this kind is, therefore, badly adapted for stacking. While, as already pointed out, the small coal offers a large surface on which chemical action and liberation of inflammable gas may take place, the larger pieces tend to run together and form pockets and channels whereby air can slowly percolate through the stack in quantities sufficient to keep the temperature low, but quite enough to ensure a constant supply of oxygen and maintain the chemical action. The fourth condition will be fulfilled if a coal of this description be stored in a large, deep stack, especially if very much fine coal be placed on the top so as to blanket it and keep the heat in; a good rule to follow is to limit the stack to such a size that no part of its interior is more than 10 ft., or preferably 8 ft., distant from its free surface. If the coal can be deposited in small heaps of from 30 to 60 tons, and so kept for a few weeks before its final removal to the stack, its safety will be much enhanced, since much of the more volatile and dangerous constituents will then be got rid of. While it may be objected that this means a loss of heating value, it must be remembered that this loss is bound to be incurred in any event, and that if it take place in the stack it involves the risk of the much greater loss of the whole, or a large part of the fuel. Stacks should be of a moderate size, and means should be provided for accurately taking their temperature in one or more places; not only should such means be provided, but they should be used regularly, and records should be kept.

Various methods have been suggested for taking the temperature of a coal stack; most of them are incorrect and misleading, the error always being the dangerous one of making the temperature appear lower than it actually is. One proposal is to drive a pipe down into the coal where the temperature is required to be taken, and lower a thermometer down it by means of a string; the method of taking the reading is to haul the thermometer madly up the pipe, and, if one has the luck to bring it up unbroken, to snatch a reading of the rapidly falling mercury, add as much as you think proper to allow for the drop in the reading which occurs when hauling the instrument up, and then pretend that a satisfactory reading has been taken. Another method is to fill the tube with water or other liquid; this is certainly an improvement, inasmuch as the reading of the thermometer does represent the correct temperature of something—although the something is not the coal in the interior of the stack but the water in the pipe; and what use that is, I am unable to see. A much more accurate, but needlessly expensive, system is to use some form of electrical thermometer, placing its resistance or thermo-couple element in that part of the stack the temperature of which it is required to ascertain. To overcome the disadvantages of these methods I have proposed the system illustrated in the accompanying sketches, this system being at once cheap, simple, and accurate. Fig. 1 shows an ordinary stem thermometer, graduated to, say, 220° F., enclosed in a glass tube such as a boiler gauge glass; both ends of the tube are fitted with corks, the bottom one being stuck in with varnish to prevent any risk of its dropping out and losing the thermometer. The glass tube is nearly filled with water, and a string attached to the upper end serves to lower it into the thermometer pocket. It is evident that, as the glass tube, water, and thermometer together have a much greater capacity for heat than the thermometer alone, no appreciable drop in the level of the mercury will occur as the instrument is drawn up the pocket, and no doubt need be entertained that the reading taken is a correct one, provided that the instrument is subjected to the correct temperature when in position at the bottom of the pocket. By proper arrangement of the pocket this can be ensured; the pocket, which, as shown in fig. 2 consists of a piece of 2-in. iron pipe of a convenient length fitted with a pointed plug at the bottom and a loosely fitting lid at the top, should contain just sufficient oil to immerse the thermometer tube completely. A very accurate indication of the temperature of the coal adjacent to the bottom of the pocket may then be obtained, from which the condition of the interior of the stack may be deduced.

No more liquid than a sufficient amount to submerge the thermometer tube completely should be placed in the pocket; if an excess be used, convection currents in the liquid may cause a low reading, and, if an insufficient quantity of liquid be used, a similar result may be due to convection currents in the air. The lid has the effect, not only of keeping the pocket free from small coal or other foreign matter and forming an attachment for the thermometer string, but also of preventing any possibility of errors due to the cold outer air obtaining ingress to the pocket.

It cannot be definitely laid down that there is a distinct temperature limit below which a coal stack is safe and

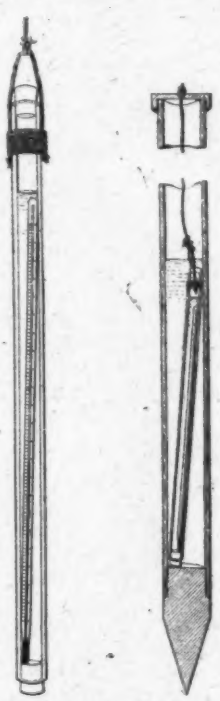


Fig. 1. Fig. 2.

above which it is in danger, though, of course, if the temperature is approaching 200° F. the stack is undoubtedly in a dangerous condition. The rate of increase of temperature is a much more important factor, and from this, together with any tendency the increase may show to proceed either faster or slower, a sound conclusion regarding the safety of the stack may be drawn. For instance, a stack whose temperature has reached, say, 140° F. but shows little or no tendency to rise further, is in a much safer condition than one whose temperature is at the time of observation low—say 110° F.—but is showing a tendency to rise more and more rapidly. It is, therefore, useful to plot a graph of the temperature on a time base, and to give special attention to any stack which may show a steep temperature graph, particularly if its slope be an increasing one. From this, the necessity for taking temperatures accurately will at once be evident, and the value of such a simple and efficient means of doing this, as has been detailed above, will need no further demonstration.

There seems to be little room for doubt that a wet coal, such as a washed slack, has a distinctly greater tendency to

overheat than a dry one. The lower portion of a wagon of washed slack is often uncomfortably hot to the touch, even though the wagon may not have stood very long. This is probably due to the greater blanketing action of the fine, wet coal, which retards the escape of the heat. For this reason it is a bad policy to put a rough dry slack at the bottom of a stack and cover any considerable portion of it with wet slack. No doubt much less risk would be run if the arrangement were reversed. A rough analogy, which will appeal to those readers, of whom there are, no doubt, many at the present time, who have had gardening experience, is that of a "smother" fire for burning garden rubbish; here slow, but steady, combustion is required, and to secure this, one puts the larger, more combustible matter at the bottom, and covers it progressively with smaller and smaller, less and less inflammable stuff, carefully providing just sufficient means for air to reach the interior. Exactly the opposite principle is the one to follow in laying down a coal stack.

On the question of ventilation very conflicting opinions exist, but most people seem to hold the belief that ventilation is an advantage. For my own part, while I am quite prepared to agree with that belief, provided that the stack is thoroughly and completely ventilated, I contend that this is a very difficult problem, and that inefficient ventilation is much worse than no ventilation at all. For example, if a stack could be sealed up completely air-tight, a little heating might occur at first until the small quantity of oxygen present in the air filling the interstices between the particles of coal had been consumed, but, after that, no further action could take place, and the stack would cool down again. But if an inefficient ventilating system were in use, the air which had been robbed of its oxygen would be replaced by fresh air, and, at the same time, the inflammable gases given off by the coal would, in a large proportion, remain in the stack, so that further heating would be the result. Further, should a fire actually break out, any ventilating system of pipes would act as flues, making it burn more fiercely by creating a draught of air, and spreading it by carrying the heated products of combustion to other parts of the stack. An efficient ventilating system would have to carry away all inflammable and hot gases from every part of the stack, thus ensuring that no dangerous accumulations whatever should take place. This is neither an easy nor a cheap matter, and a better policy is to make the stack as air-tight as possible, and to keep its depth within such reasonable limits as I have already suggested.

It is no easy matter to extinguish a stack which has already fired. Playing water upon it with a hose-pipe is not very satisfactory in its results; it even seems to have the very unwelcome one of spreading the area of the fire. Excepting as a temporary expedient to enable men to handle the coal, it should not be resorted to. If the hose pipe be used from the top of the stack there is considerable risk of a quite dangerous explosion taking place when the water reaches the fire; considerable quantities of steam, hot water, foul gas, and cinders may be shot up, with possibly serious results. The best policy is, if the stack is a small one, as it ought to be, to remove the whole of it, and, if possible, use it on the boiler fires at once. Parts of it which have not suffered much damage may be used to form the beginning of a new stack; as they will have lost much of their volatile constituents they should, after cooling, be perfectly safe. If the stack is, unfortunately, a large one, the area of the fire should be located and isolated from the remainder by digging a division through the stack as quickly as possible.

The process of removing coal from a burning stack is an unpleasant and dangerous one, and the necessity for it should be avoided as far as possible. I will, therefore, conclude by summarising the means by which coal may be stored in stacks with a minimum of danger. The coal should not be stored in one large stack, but in several stacks each of a moderate size; the depth of each stack should be such that no part of the coal is more than 10 ft. at the most distant from the surface; accurate temperature readings should be taken regularly and recorded. If possible, the coal should be graded; the fine at the bottom, the coarser at the top. Ventilation should not be used; the coal may with advantage be dumped in small heaps to season prior to stacking. I have little doubt that the more closely these rules are adhered to the less will be risk of loss due to spontaneous ignition.

THE INSURANCE OF ELECTRICAL MACHINERY.

By C. STUART BUYERS, A.M.I.E.E.

(*Concluded from page* 581.)

Colliery companies are possibly the class of electric power users who favour insurance most. This is only natural, as the conditions of working in coal mines are hard, and breakdowns are frequent, especially in wet mines, where the air is laden with moisture.

The average colliery manager or owner places great value on the insurance company's quarterly reports. Although not an expert in electrical matters, he has sufficient technical knowledge to understand thoroughly the defects reported, and he will usually feel impelled to aid his electrician by giving facilities to have a faulty motor or armature brought to the surface for overhaul.

When a breakdown occurs and the defective part is sent away for repair, he receives one or more reports stating what repairs are being executed, and when the part is likely to be ready for dispatch.

At certain collieries possessing a number of electric coal-cutters, together with a considerable amount of other underground electric plant, it is not unusual to have an armature burnt out, on an average, once a week. Although in these cases the premium charged is high, the fact that the repairs are carried out under supervision, relieves the colliery officials from a considerable amount of correspondence, and any doubts whether they are being overcharged for repairs, do not arise, as the accounts are rendered direct to the insurance company.

The majority of collieries are entirely dependent on electrical machinery to maintain their output, and owners realise that efficient inspection is a valuable feature to ensure continuity of output. It is for this reason that the percentage of colliery companies who have tried insurance and given it up is extremely small.

The adoption of turbo-alternators by many of the smaller municipalities and electric supply companies has caused these concerns to consider the question of insurance.

Turbine plant is by no means beyond the possibility of breakdown, as anyone with experience of this type knows to his cost, and it is the "glorious uncertainty" and the extensive amount of damage which may occur in a few seconds of time which dictate insurance to all users except, perhaps, a few large undertakings having a special reserve fund to meet contingencies.

A fairly large turbine set will cost some £20,000 complete, and it may be insured for the full amount if desired, or against damage amounting to, say, £10,000 or £7,500.

The question of damage to surrounding property should be carefully considered when insuring turbo-alternators, as the ordinary policy only covers damage to the machine itself by breakdown. It is, therefore, in many cases, advisable to have the policy endorsed so as to include damage to surrounding property. The risk of external damage is not great, and consequently the additional premium is small percentage.

A case occurred a short time ago illustrating the uncertainty of turbo-alternator risks. An H.T. machine of about 1,000 KW. capacity was insured when it was installed and it worked in an exemplary manner for several years. So satisfactory was its behaviour, that the firm who owned it decided to give up insuring it; but only a few months after cancelling their policy a serious breakdown took place, necessitating considerable expenditure for repairs. Needless to add, the machine was insured again when it was repaired and resumed work once more.

As the use of electric power is growing rapidly among small power consumers, for whose requirements one or two motors are sufficient, and who thus do not require to employ an engineer or electrician, electrical insurance and inspection

appears to have a considerable future before it, and additional electrical surveyors will be required each succeeding year.

The qualifications required of a surveyor are twofold, and, to use an American mode of expression, they may be stated as follows :—

Tact and common sense ...	...	...	50 per cent.
Engineering knowledge ...	...	...	50 per cent.

It goes without saying, that an electrical surveyor must have a good theoretical training, so that he can diagnose irregularities in the working of the machinery he inspects, and thus indicate the remedy. A good practical knowledge of armature winding is very useful when dealing with repairs, but is not essential.

Some insurance companies require candidates to sit for a written examination of an elementary description, but, usually, an applicant's theoretical qualifications can be suitably judged by the certificates he holds from technical colleges. A tactful manner in dealing with clients when breakdowns occur is a *sine qua non* to the inspector who means to be successful.

Occasionally a breakdown arises which requires delicate handling by the inspector, such as, for example, the case of an attendant examining a motor with a lighted taper, and thereby setting it on fire owing to accumulated wool fluff and oil about the brushgear.

A breakdown policy would not cover damage to windings from such a cause, and unless the owner was insured against fire, he would require to make good the damage, caused by his employé's carelessness, at his own cost.

Such incidents, fortunately, are infrequent, and if the matter is explained in a judicious manner, no feeling of injustice will be left in the mind of the owner.

Many persons, on receiving a policy of insurance, lock it in a safe without reading the printed "Conditions" and "Definitions." These "Conditions" state in legal phraseology that while the insurance company is liable for all breakdowns happening to the machine itself whilst at work, unless caused by habitual overloading, the owner may require to renew, at his own expense, certain parts, such as carbon brushes, commutator, or bearing bushes, which are liable to wear out from time to time.

In conclusion, it may be stated that policies are issued for a year at a time, and it is open to either the insured or the insurer to cancel the policy at the annual date when it falls due for renewal.

This is a valuable safeguard to both parties to the contract, and it tends to ensure smooth working and prevents any high-handed action.

THE GOVERNMENT AND FOREIGN TRADE.

(*Concluded from page* 582.)

We are glad to learn that it is proposed to bring about measures of reform in connection with the *Board of Trade Journal*. We do not wish to underrate its past usefulness, but we shall certainly welcome it in its revised form if it is going to be of real value in circulating articles founded on official information which will help the traders of the country promptly, and if it is going to co-operate with the trade journals—an office which it has filled in an acceptable but limited way in the past.

We presume it will not be long now before the Government is able to announce the names of the twelve new Trade Commissioners from whom we expect so much. We believe that practically all of them will be found to be men of business experience; but until the names are known we shall be unable to estimate how far their qualifications promise well in respect to the great engineering and electrical industries, in the future of which we are naturally more directly interested. We have long observed how valuable have been the services rendered by the four Trade Commissioners acting for us in Canada, Australia, South Africa, and New Zealand, and we trust that now that the number is increased to sixteen, spreading their efforts over wider fields, British industry will be materially advantaged, but our manufacturers and traders will require to show a full measure of confidence in their ability by availing themselves of the valuable co-operation in information and action which these Commissioners are able to afford them. This remark applies to the period of activity of these officials while in the markets to which they will devote their energies, and also to their visits Home when our firms are able to interview them. Of course, at this date it goes without saying that the Commissioners will require to be most fully informed regarding our industrial manufacturing ability and capacity before starting to take up their posts abroad. It is reasonable to suppose that, however extensive their general knowledge of certain trades may be now, they will have other things to learn before they proceed to the scene of action abroad. It has been obvious in the past that only first-class men will be possessed of the training and experience that will fit them for this very important duty to the State and to industry, and we are glad to know that it is intended that the remuneration and allowances are to be such as to make the posts attractive to men of the required type. As we had occasion several years ago to urge an improvement in the remuneration of our Commissioners, we welcome the more reasonable treatment that is to be meted out to this branch of the Overseas Intelligence Services. It is intended that the Commissioners' extended activities will affect India and some of the Crown Colonies and Protectorates, as well as the self-governing Dominions. The Commercial Attaché Service is also being reorganised and greatly increased in numbers. The control of both these Services has been handed over to the new Department. The improvement of the Consular Service, the need for which everybody recognises, is also being dealt with, but very many matters in this connection require adjustment, and when so many excellent men who could fill such posts with distinction and success are engaged with the Forces, it is not possible to proceed so expeditiously as might have been done were they available now. The Consular Service is not as yet under the control of the new Department, but for the present it has been placed under Sir A. Steel-Maitland's personal charge as Parliamentary Under-Secretary in the Foreign Office. It is proposed that the Commercial and Consular Departments of the Foreign Office shall be definitely assimilated by the new Department when adequate accommodation for the entire new Department has been obtained near the Foreign Office.

There can be no question that Sir A. Steel-Maitland has personally a correct appreciation of what German commercial strategy has been in the past. It is almost impossible to doubt that those who are working under, or in co-operation with, him will have that same understanding of the situation and of the responsibility resting upon us as a nation to be equal to whatever the future may bring forth. This new organisation, given, as we say, goodwill on the part of its different sections, also confidence in its intentions and abilities on the part of traders, should go far to give us the needed measure of Governmental assistance, as regards intelligence service, that is required.

Since the foregoing was written the following official announcement has appeared in the *Board of Trade Journal*:—

The new Joint Department of the Board of Trade and the Foreign Office has now been constituted.

The new Department will be known as the Department of Overseas Trade (Development and Intelligence). It will be represented in Parliament by Sir Arthur Steel-Maitland, M.P., who will occupy the position both of Additional Under-Secretary of State for Foreign Affairs and also of Additional Parliamentary Secretary at the Board of Trade. The Department will comprise the existing Department of Commercial Intelligence of the Board of Trade, including the management of the British Industries Fairs, the War Trade Intelligence Department, the section of the Foreign Trade Department* of the Foreign Office dealing with Form K and with other matters relating to the promotion of trade abroad; and certain functions now performed at the Foreign Office in connection with commercial intelligence and with the Commercial Attaché and Consular Services. Sir William Clark, K.C.S.I., C.M.G., has been appointed Comptroller-General of the new Department, and Mr. F. G. A. Butler, C.B., C.M.G., formerly of the Colonial Office, has been appointed Director of the Overseas Division.

The temporary headquarters of the Department will be at 73, Basinghall Street, London, E.C. 2, to which personal letters for Sir Arthur Steel-Maitland should be addressed. The Commercial

* Attention is called to the fact (as regards which some misconception has prevailed) that the whole of the rest of the Foreign Trade Department will remain as heretofore under the Controllership of Sir Ernest Pollock, K.B.E., K.C., M.P., at Lancaster House.

Intelligence staff will for the present continue to be housed at the same address. The office at Basinghall Street contains an Inquiry Bureau where information on all matters affecting trade can be obtained on personal application; or inquiries can be addressed there either by post or telephone (telephone numbers, London Wall, 4713 to 4717.

The War Trade Intelligence staff will remain at their existing offices in Lake Buildings, London, S.W. 1.

WIRELESS TRANSMITTING STATIONS ON GERMAN AEROPLANES.

Some highly important and interesting information on the means adopted by the Germans for signalling between aeroplanes and land batteries, infantry, &c., is given in *La Nature* for December 8th. It is realised, of course, that owing to engine noise, &c., aeroplanes can only transmit, and not receive wireless messages.

The receiving station on the latest type of German aeroplane consists of :—

1. A generator of D.C. and A.C.
2. The oscillating circuit.
3. The antenna.

1. At first the necessary current was provided by a storage battery. Difficulties arose, however; the batteries were very heavy, very fragile, and liable to be discharged rapidly. Small A.C. and D.C. generators were then fitted. These generators are driven by an air screw, or are coupled to the aero motor by a coupling (clutch) operated by the pilot. The generating plant, styled "J. A. Flieg, 1917," by the Germans, comprises two generators mounted on the same shaft. One of these, forming a simple dynamo, supplies the D.C., and is used for exciting the alternator, for the oscillator circuit, and probably also for lighting the lamps and projectors on the aeroplane.

The other generator supplies the A.C. for the oscillating circuit.

The three types of transmitter actually employed are the "Sender" type C, 1916, the "Hüth transmitter," and the "Telefunken transmitter."

Underneath the alternator is a sort of case, into which 12 terminals lead. These terminals permit of inserting in the exciting circuit different values of a resistance placed in series, and housed under the generator.

According to the type of transmitter fitted on the aeroplane, these terminals are used with the corresponding types of current. For check purposes they are connected up by connecting plates corresponding to the transmitter employed, the connectors being small plates of insulating material.

In the cover of the case mentioned above is a small transparent window for observing whether the generator is properly regulated in respect of its oscillating circuit. The generators are constructed so as to work rotating either right or left, according as they are driven by air screws or by the aero engine. The type of generating set just described weighs, with its air screw, cables, &c., 10·3 kilograms (about 23 lb.). The driving screw is designed to give a speed of 4,500 R.P.M. with a wind speed of 150 km. (say 90 miles per hour). Variations of aeroplane speed do not appreciably affect the output of the generating set. The set is air-cooled.

2. *Transmitting Apparatus.* — The "Telefunken" apparatus comprises the usual parts, the whole being contained in a case measuring about 14 in. × 10 in. × 6 in., and weighing some 19 lb. These parts are: a transformer, a condenser, a plate-type spark gap, and a variometer. There is a three-stud contact device for varying the intensity of emission by a rheostat in the excitation circuit, and at the same time decreasing the resistance of the spark-gap by short-circuiting part of the plates.

Another three-stud contact permits of employing three different wave lengths, viz., 150, 200 and 250 metres, by using one or more turns of an Oudin coil. The variometer (variable self-inductance) permits of tuning the aerial with the primary circuit. The observer knows that his circuit is properly regulated when the ammeter pointer attains a maximum.

3. The transmitting aerial is formed by a 1-mm. diameter copper cable about 40 metres long. This wire, which hangs below the aeroplane, tends to assume a nearly horizontal position by reason of its inertia and the wind resistance.

A special arrangement is provided for preventing the antenna swaying, and for ensuring that the correct length is unwound. The manipulator and ammeter are of the usual type. The conductors of this system are insulated and mounted in special flexible aluminium tubes.

The total weight of the complete set is as follows—

Oscillatory circuit	8·7 kg.
Generator system	10·3 „
Aerial, &c.	3·7 „
Manipulator, wiring, and ammeter ...	3·0 „
	25·7 kg.

or, say, ½ cwt.

The mean range of the set seems to be about 35 kilometres, or something over 20 miles.

Every squadron of the German Army Service Corps attached to the air service includes a tractor wagon specially fitted up for dealing with repairs to, and tests on, wireless sets.

The article from which this information is derived is fully illustrated by photographs and diagrams.—E. S. H.

JUSTIFIABLE INDUSTRIAL UNREST.

By G. BASIL BARHAM.

Everyone who is in close touch with the engineering trades is aware that a good deal of unrest exists, and that this is due principally to the inequality between the wages paid to those who have been in the shops since boyhood, and who have attained a high degree of skill, and those who have drifted into the fitting and machine tool shops since the war, and who possess neither experience nor special skill. These men are engaged principally on repetition work, and in many instances can earn, with comparatively little effort, more money than those who have been in the trade for years. No one with a sense of equity can endorse a system of payment under which a labourer who merely feeds metal bars into an automatic machine receives more than the skilled supervisor, tool maker, or tool setter, on whose accurate work the correct running of his machine depends. Yet this is the system which obtains in a great number of shops, and countless instances could be given where the difference in wages runs into pounds per week rather than shillings.

Since this inequality was first recognised, a number of movements have aimed at rectifying the anomaly, but neither individually nor collectively have they achieved their object; and it is hardly to be wondered at that the skilled workman, irritated at their failure, has been tempted, in some instances, to take matters into his own hands, and see whether by *force majeure* he cannot bring about a better state of things.

The weapons he has employed have been threats to stop work, threats to stop all overtime, threats to stop dilution, and even to restrict production by less creditable and legitimate means. No talk of payment by results will meet his approval, as he knows that amongst many grades of engineers—especially those possessing considerable skill—piece-work rates or premium bonuses could not be introduced. General fitters and turners, the more skilled amongst the pattern makers, and tool setters are men who could not be paid at piece-work rates, at least for the greater part of their work, although it is true that many of the setters-up and some of the tool-room hands share in the bonus earned by the men in charge of the machines for which they look after the work-setting and the tool-making and setting respectively.

It is time that the employers generally recognised the fact that the skilled workmen are strongly opposed to the establishment of any system of "premium bonus." The Employers' Federation would be well advised to give way

on this point; as a matter of fact, it has little to commend it, and it is generally admitted to be unfair, as under it men only receive a portion, and not the whole, of the value of the time they save for their employers. A man rightly argues that if he, by special effort, succeeds in doing 60 minutes' work in 45 minutes, the value of the saved 15 minutes should belong to him, more particularly as he feels that the employer receives his share of the benefit in the extra amount of work done.

In some parts of the country a scheme of collective piece-work payment has been adopted, and it has met with a certain amount of success in United States shops. It is admitted that American "scientific management" has failed up to now to serve as a medium for reconciling deep-rooted differences between employer and employed; but the system of payment mentioned has many good points. Where adopted, it is arranged that piece prices shall be fixed at such a rate that an ordinary workman can make time-rates plus 50 per cent., these prices being fixed by mutual agreement. A day worker who cannot be placed on piece-rates shall be paid a bonus which shall bring his wages up to the average amount earned by the piece-workers; and although this is merely a bald statement of the scheme, and although it is admittedly imperfect in some respects, it is a scheme which at the present juncture might be introduced with advantage, as it would do away with the majority of labour troubles.

From the employers' side it might be urged that under such a scheme the energy of the piece-workers might result in a higher addition to the wages of the day workers than they expected or demanded, and that, consequently, they would be satisfied with less. To those who argue in that way it is sufficient to say that the war has revolutionised the old ideas as to the relations between Capital and Labour; it will do away with the "Ca'-canny" master as well as the "Ca'-canny" workman, and it is gradually becoming recognised that the labour of the man who works with his brains and the labour of him who works with his hands are both worth exactly what they can obtain. In both cases the only test of reasonableness is the price that can be commanded. Masters must put aside the old idea that the amount of wages paid per week is of any importance, and realise that the only thing that matters is the cost per unit of their production.

REINFORCED CONCRETE POLES FOR TRANSMISSION CABLES.

By A. V. CHITTY.

(*Paper read before the* Association of Mining Electrical Engineers, North of England Branch.)

The colliery where these poles, to be described, have been made and erected has undergone a complete change; for no electricity of any kind had been in use before. The new houses for engines, pumps, boilers, &c., have all been built with reinforced concrete, so that when the poles came to be made everything was ready for the purpose.

As the poles were not required for a few months, one mould served to make them all. The mould was made ready; then as opportunity occurred the concrete was put in, and when finished left to set for about 14 days, according to the weather. A little water was thrown over the concrete occasionally to assist the hardening, and when set sufficiently the box was taken off and made ready for another mould. At this stage the poles were quite "green," and not safe for handling.

The concrete mixer was kept going principally to make concrete for the buildings, &c., but there are periods during work of this description when delays occur, especially at the present time. When the mixer was not supplying concrete for buildings, the concrete was used for moulding a pole.

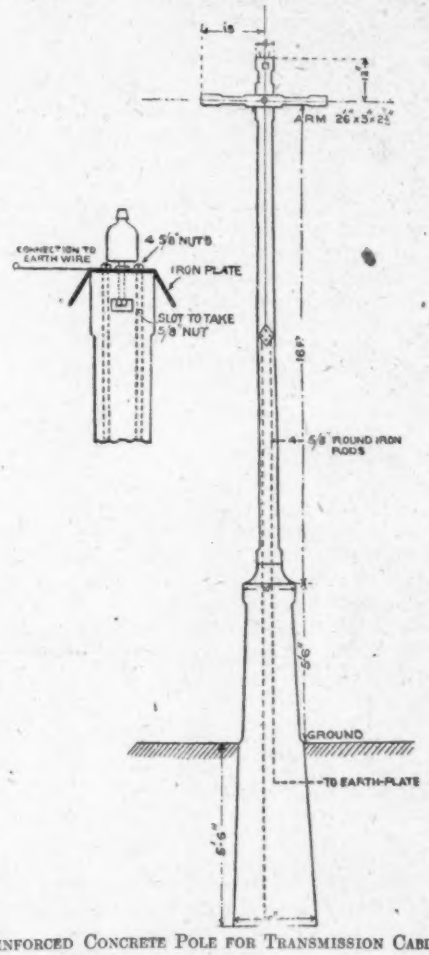
The illustration gives the dimensions of the pole. Reinforcing rods run the full length, and iron wire was fastened in between the rods to give a better binding. One rod was bent about 4 ft. from the bottom of the base, and brought out at the side. An earth-plate was attached to this rod after the pole was erected. At the top the rods project for sufficient distance to take an iron plate about 3/16 in. thick and a ¾-in. nut. A hole was left in the top to take the top insulator spindle, and a slot in one side to enable the nut to be secured. A rod was fastened to one of the nuts to carry an overhead earth-wire. About a foot from the top a slot was left to take the cross-arm and a bolt-hole for securing it.

The arms were 2 ft. 6 in. long by 3 in. square, chamfered at the edges, and secured to the pole by a ¾-in. bolt. Three inches from each end of the cross-arms are the insulators. The shortest distance between the wires, provided they are all at an equal tension, is about 15 in., which for a 440-volt, 3-phase transmission is ample.

The weight of a 28-ft. pole is about 2 tons 7 cwt. Each pole was placed on rollers and moved to its place of erection, care being taken to see that the rollers were fairly equi-distant to obviate risk of cracking the concrete, which did happen in one case. The best method is to move the pole on planks strapped to it.

The ground where these poles were set was good solid clay with about 8 in. of soil at the top. The hole was stepped down to about 5 ft., so as to leave a solid wall at the back. The pole was then placed over the stepped side of the hole and set into position by means of a derrick.

A board was placed against the back wall to prevent it burying itself in the ground and breaking the earth away



Reinforced Concrete Pole for Transmission Cables.

while being lifted. No stay wires were used, as they were not considered necessary in a sheltered colliery yard; also the length of span is only about 40 yds. For a transmission line, say from one colliery to another, through open country, wind stays might be necessary.

One of the reinforcing rods of each pole has an earth-plate attached at the base, and the poles are connected together by an overhead earth-wire which terminates at a steel tower. The wire is taken down the tower and connected to two earth-plates about 20 ft. apart. These plates serve as a central earth for all the surface motors and the underground circuits. It is not necessary for each pole to have an earth-plate, but they were convenient for connecting the motors to. In the case of a long line with a number of poles, an earth-plate at every fifth pole would suffice.

The approximate cost of the pole is about £3 10s., including reinforcement and the mould. A wooden creosoted pole would cost at the present time about 2s. a foot. The life of a wooden pole would be, say, 15 to 20 years, whereas a reinforced concrete pole should last as long as the colliery. For general appearance and strength, concrete is best.—*Iron and Coal Trades Review.*

GAS-FIRING BOILERS.

Mr. T. M. Hunter's paper was read before the members of the Birmingham Local Section of the Institution of Electrical Engineers on December 5th. An abstract of the paper appeared in the Electrical Review for December 7th and 14th.

In the discussion, Mr. W. N. Y. King said that an important factor was the question of dust in the flues. In a paper on "Waste-Heat Boilers in Steam Plants," read by Mr. C. J. Bacon before the American Iron and Steel Institute, open-hearth practice was referred to, and it was stated that dust was blown off the tubes every six hours. This was a serious item, as in the case of coal-fired boilers two or three times a week was considered quite frequent for this operation. The result of leaving the dust on the tubes was a great loss of efficiency, on account of reduction of heat transmission; the amount of this was shown in some figures published in the *Electrical Review and Western Electrician*, September, 1917, as follows:—

Thickness of soot on tube ...	... 1/32	1/16	1/8	3/16 in.
Loss of conductivity per cent. ...	9.5	26.2	45.3	69.0

The use of waste products as mentioned had been tried at various times, and the main obstacles to successful working had been reduction of output from the plant due to the large amount of refuse, and the increase in labour costs and difficulty of disposing of the refuse. Even with coal of the quality obtainable at the present day, the handling and disposal of ash and clinker was a serious item of expenditure. The infiltration of air had an appreciable effect on the efficiency; boilers should be fitted with tight casings, and these maintained in good order to reduce losses to a minimum. Explosions, which occurred at times due to unburned gas accumulating in the flues, were not often so violent as to disturb the stability of the boiler, but did affect the walls, loosening the joints, which had to be made good again if heavy losses due to air infiltration were to be avoided.

Mr. A. Goldie Engholm said Mr. Hunter had not given any definite information concerning the costs of gas-firing boilers. So far as he was aware, it did not pay to put down gas plant to recover the various by-products unless the plant could deal with, say, two to three hundred tons of coal per day. Mr. Hunter stated that a 30 ft. by 8 ft. Lancashire boiler to evaporate 6,000 lb. of water would require 71,000 cu. ft. of gas per hour at 107 therms per cu. ft. If the gas could be supplied at 1½d. per 1,000 cu. ft., this would work out at about 9s. per hour for the gas alone. He did not think that at present gas at 107 therms could be supplied at 1½d. per 1,000 cu. ft.

Mr. R. L. Goold said the author emphasised the importance of minimising the excess of air. The admitted air, even when pre-heated, was, he presumed, at a temperature of 100 or 200 deg. C. The excess air had to be raised to a temperature of 1,200 or 1,500 deg. C. The consequent reduction of calorific intensity was obvious. They had to operate between this evil and the evil of unburnt gases in the stack. These unburnt gases probably consisted largely of combustible gases which had been manufactured in the flame, as distinguished from gases which had escaped from the burner. It was conceivable that the wetted surface of the boiler might be the means of so reducing the temperature in a region in which the regenerated gases were liberated that they escaped combustion. The importance of thoroughly mixing the air was emphasised in the paper; this mixing of the air with the gas was, however, a matter of the greatest difficulty, and the regenerated gases escaped combustion on this account also. He suggested an inquiry as to whether the desideratum of substantially complete combustion with a minimum of excess air could be more nearly attained by a gas-fired boiler, the design of which was founded, *inter alia*, upon a recognition of the existence of combustible gases generated in the flame.

LEGAL.

Gas Light & Coke Co. v. The Metropolitan Borough of Hackney.

The Court of Appeal on Tuesday, December 18th, delivered judgment in this case.

Lord Justice Swinfen Eady's judgment is abstracted below:—The relators complain that the defendants, who are empowered to supply electrical energy within their districts, are committing breaches of Sections 19 and 20 of the Electric Lighting Act, 1882. They complain that the defendants are supplying electrical energy for lighting on different terms instead of the same terms to persons taking under similar circumstances a corresponding supply contrary to Section 19. They also complain that the defendants are showing undue preference to persons taking current for lighting who also take it for power, contrary to Section 20. Mr. Justice Astbury decided that the relators had failed to give any breach by the defendants of the statutory provisions, and dismissed the action and the relators' appeal.

The scale of charges of which they complain is set out in paragraph 5 of the Statement of Claim, and was contained in a circular issued by the defendants in July, 1914. The plaintiffs do not make any complaint as to defendants' charges for energy for lighting, or for power alone; their complaint is limited to the provision enabling power users taking current under the B.1 scale to consume up to 20 per cent. of the energy so taken in lighting their factories. The substance of the plaintiffs' complaint can be put in a very few words. They say that if two customers take from the defendants energy for lighting under what they allege to be similar circumstances, as, for instance, if two customers take current for lighting their factories, and one has steam or gas-engine motive power, and the other takes from the defendants electric current for his motive power, the latter is able to obtain his lighting at a cheaper rate than the former. The plaintiffs contend that in such case both customers take energy for lighting under similar circumstances, and ought to be charged at the same rate for such energy. The defendants dispute that both customers take current under similar circumstances, and contend that the customer who takes one combined supply for lighting and power—who takes at least four units for power for each unit for light—is a better customer for the electric station, and takes energy under different circumstances from one who takes it for lighting only.

The plaintiffs' contention is that the defendants ought to have a third scale—namely, an intermediate scale for customers who use current for light and power, higher than the scale charged to power users only, and lower than the scale charged to light users only.

In approaching the consideration of the matter in dispute, it must be borne in mind that customers affect the central supply station differently according to the different circumstances under which they take current. The purpose for which current is taken is immaterial, except so far as the station is affected by the amount taken and the circumstances under which it is taken. An ideally perfect customer would be one whose maximum demand on the station was also his minimum, and whose load remained constant throughout the whole year. Speaking generally, it is agreed that customers for power have a better load factor and more favourably affect the diversity factor of the station than customers for light. A figure of 25 per cent. was accepted as a general figure of load factor for power users. The general figure given as the load factor of light users was 12.5. The diversity factor of the station is, speaking generally, more favourably affected by power users than by light users. It is essential to bear in mind the effect of load factor and diversity factor on the working of an electrical undertaking when considering the scale of charges. It appears that defendants' charge under scale A.1 for lighting is nearly double the charge under B.1 for power. Under A.1, if the unit be taken at 5d. for the purpose of calculating the cost of one hour's supply at maximum demand, and then all current consumed be charged at 1d. per unit, the annual charge per KW. of maximum demand will be £7 11s. 8d., as against the fixed charge of £4 per year per KW. for power, and the charges for current will be 1d. per unit for lighting and ½d. per unit for power. No complaint is made of these charges if enforced for light only or power only, as the case may be. It is now necessary to consider the position of a power consumer who is allowed to use for lighting 20 per cent. of the energy he takes. Sir John Snell, the electrical engineer called by the plaintiffs, agreed that in so far as a power user consumed for lighting 20 per cent. of the current taken, his load was rendered worse than if he used all current taken for power alone, and that, as a class, a power user although consuming 20 per cent. of current for light had a better load factor, a better diversity factor, and was a better customer than one taking only current for light, and he concurred in the view that the average price which should be paid by a consumer taking current for power, and using part of it for light, should be higher than was paid by a customer taking current for power only, and lower than was paid by a customer taking current for light only. The defendants point out that this is the effect of their automatic scale, and that in proportion as the load factor of a power user is rendered worse by his taking current for light, to that extent will he pay at a higher rate for all energy consumed, as the worse his load factor the higher the rate at which he pays for current taken. The table put in by Mr. Merz shows how this works out in the hypothetical instance taken; exactly in the proportion in which the load factor becomes worse, the smaller is the relative quantity of current over which the fixed charge has to be spread, and accordingly the cost per unit of current consumed rises in proportion. Down to this point, I do not understand that the plaintiffs dispute the position. But they contend that this result is arrived at without considering another element, namely, the diversity factor; and they urge that if a customer takes power only at a similar load factor to one who uses current for both purposes, they will both be charged at the same rate for all current taken, although, by reason of the latter customer adversely affecting the diversity factor of the station, he will be a worse customer than the one with the same load factor taking for power only. At most, it comes to this, that given two power users with the same load factor, one only using current for lighting, they pay at the same rate, and thus, it is said, lighting is given at a cheaper rate than it is supplied at to a customer taking current for lighting only. No doubt it is. In my opinion, how-

over, a customer who takes current for power as well as lighting, being a more beneficial customer to the undertaking, and taking at least four units for power for every unit for lighting, cannot be said to be taking a supply under similar circumstances to one who takes for lighting only. Indeed, the appellants conceded in argument that such two customers might be charged a different rate. What seems to be the plaintiffs' real grievance is, not that two light users are charged a different rate, but that two power users are charged at the same rate through each having the same load factor, although one uses part of his current for lighting. Mr. Colefax criticised the use which the defendants' counsel made of the table, and the way they dealt with it in argument. He contended that the table takes no account of the diversity factor, but merely shows that every power user pays according to his load factor, neither more nor less, because the difference of load factor is taken into account in the method of charging. It must be remembered, however, that we start with this—that using current for light as well as power renders worse the load factor. If, therefore, two power users have the same load factor, although one uses current for light, it follows that without using current for light they would have had different load factors, and, as such, would have been charged at different rates if worked out per unit per consumer; it is only by reason of one of these customers also taking current for light, and so adversely affecting the load factor, that he is reduced to the same level or charge as the other customer, who has a worse load factor than his own for power only. The effect of the sliding scale is that it does in fact introduce and adjust a third scale for power and light combined, the charge being higher than would have been the charge for power only, and lower than would have been the charge for light only. The appellants have, in my opinion, failed to show any breach by the defendants of either Section 19 or 20 of the Act of 1882. The case of the Attorney-General *v.* the Long Eaton Urban District Council is clearly distinguishable from the present. In that case, where power and light were both taken, the charge was at a lower rate than when power only was taken, although the consumer was not so good a customer to the station. Again, a difference was made when partial lighting only was taken, so that if any lighting was obtained from any other source the higher rate was charged. The Long Eaton case cannot govern the present one. In my opinion the appeal fails, and should be dismissed.

Lords Justices Warrington and Scrutton also delivered judgments dismissing the appeal, which was accordingly dismissed with costs.

KENSINGTON & KNIGHTSBRIDGE ELECTRIC LIGHTING CO., LTD., *v.* THE NOTTING HILL ELECTRIC CO., LTD.

IN the King's Bench Division, on Wednesday, December 19th, Mr. JUSTICE MCCARDIE had before him this special paper case, which came up upon the consideration of an arbitrator's award adverse to the Notting Hill Co. upon a dispute between the two companies with reference to the use of electrical power from a joint station. The case was reported in the ELECTRICAL REVIEW of July 20th, 1917, and the arbitrator's award in that of October 12th, 1917.

Mr. Tomlin, K.C., and Mr. Bruce Thomas were counsel for the Notting Hill Electric Lighting Co., and Mr. Vesey Knox, K.C., and Mr. Marriott represented the Kensington and Knightsbridge Electric Lighting Co., Ltd.

Mr. TOMLIN, K.C., in opening the case, said that he represented the Notting Hill Co. on a special case where an award had been made by Mr. Swinburne. The case arose out of a difference that had resulted between the two companies in reference to their obligations under certain agreements which they had entered into, and under a special Act of Parliament in regard to the same matter. These agreements related to the erection and maintenance of a joint generating station, and the nature of the question in dispute between them was substantially as to whether or not the Notting Hill Co. in certain circumstances had failed to take from the joint generating station the amount of electrical energy which, by reason of their obligations under the agreement and the Act, they were bound to take. It was alleged against the Notting Hill Co. that they ought to have taken more current than they had taken from the joint station, but his case was that one of the purposes for which it was alleged they ought to have taken current, and for which they had not taken current, was a purpose that was outside of the Act altogether, and for which it would never have been possible for the generating station to have supplied current consistent with the provisions of the Act. Under the agreement it was provided that the output of 1,800,000 watts might be used by the companies as they should require, but it was afterwards agreed between the two companies that the Kensington Co. should not be entitled to use more than 1,200,000 watts without the consent in writing of the Notting Hill Co., and the Notting Hill Co. should not be entitled to use more than 600,000 watts without the consent in writing of the Kensington Co. If the joint station was unable to supply the total output required, the companies could take the available output in accordance with the proportions indicated, or in such proportions as might be agreed upon from time to time. Under this agreement, the Notting Hill Co. had taken their maximum, and yet they had been fixed with damages in the arbitrator's award for not having taken more. After dealing in detail with the various agreements and the provisions of the Acts conferring the powers on the companies incidental to the erection of the joint power station at Hammersmith, Mr. Tomlin said his case was that the Act authorised the acquisition of land and the construction of the joint station for one purpose only—for supplying energy within the areas of supply for the time being authorised, and nothing outside of those areas fell within the scope of the agreements, and any agreement, therefore, for the use of electrical energy supplied by the joint station for some purposes outside of that would have been *ultra vires*. Here the Notting Hill Co. had had damages awarded against them for not taking from the joint station energy for a district that was outside of the statutory area. The fact was, they could not have supplied that district from the joint power station except at enormous commercial loss, as it involved a low-tension continuous supply, and they could not, and would not, have done it.

Mr. VESEY KNOX, K.C., interfering, said that the arbitrator who had made the award was an experienced electrical engineer; the Notting Hill Co. set up before him the case that they could not possibly have taken this supply from the joint power station, and the arbitrator found against the Notting Hill Co. on that contention. The case for the Kensington & Knightsbridge Co. was that the supply could have been, and should have been, given from the joint station.

Mr. TOMLIN said that their case on this was that the supply could only have been taken from the joint power station at great commercial loss, and the evidence on the other side was also to the same effect. They would not have been able to supply this district at all except for the fact that they were able to make arrangements for the supply from another source. An arrangement was made with the Metropolitan Co. The district in question was the Kensal New Town locality, and the arrangement began about the year 1909. He asked the Court to declare that the arbitrator's decision was incorrect, because energy could not be taken from the joint station for any purpose outside of the area. Counsel proceeded to deal with the effect of the Electric Lighting Act of 1909, which, he suggested, gave a licence to use outside of their area some energy for particular purposes. This licence was to supply at their will and pleasure to particular places. The Kensal New Town district had no characteristics of the statutory area.

Mr. JUSTICE MCCARDIE: So that one of the chief questions in the dispute is whether premises covered by this licence under the Act of 1909 constitute an extension of the original statutory area?

Mr. TOMLIN: Yes—whether those districts come within the area of supply authorised by the agreements and the Acts.

The case was adjourned till Thursday, December 20th.

At the close of the arguments his Lordship reserved his judgment until the 1918 sittings.

THE OSRAM-ROBERTSON LAMP LITIGATION.

MR. HUNTER-GRAY on December 20th, in the Chancery Division, before Mr. Justice Eve, moved for judgment in two cases in which the Osram-Robertson Lamp Works, Ltd., were the plaintiffs, the first being against the Serena Supply Co., and the second against the Electric Lamp Supply Co. Mr. Hunter-Gray, in reply to the Judge, said that the circumstances were exactly the same as in a case in which his Lordship had previously given judgment. The papers were all in order, and it was a consent order for which he was asking.

His LORDSHIP: Then take your orders.

WAR ITEMS.

Export Prohibitions.—A notice of various additions to and alterations in the list of exports prohibited appears in the *London Gazette* for December 18th.

Exports to China.—Additions to the names of persons and bodies in China and Siam to whom exports may be consigned are published in the *London Gazette* for December 18th.

War Loan.—Big subscriptions to the War Loan during Manchester's great "Tank Week" included £25,000 from the British Westinghouse Manufacturing Co., Ltd., £5,000 from the General Electric Co., Ltd., £25,000 from Messrs. Charles Macintosh & Co., Ltd., and £10,000 from the Chloride Electrical Storage Co., Ltd.

Sale of Electric Heating Apparatus Forbidden in Rome.—The *Times* correspondent at Rome states that a new decree limits the use of electric light, prohibits the use of electricity for heating between 4 and 10 p.m., and forbids the further sale of electric heating apparatus. Gas is already shut off the greater part of the day, and will shortly be cut off altogether for heating purposes. Wood and charcoal are very scarce.

Trading with the Enemy.—In the "London Gazette" for December 21st there appear further lists of persons and bodies with whom trading is prohibited in the following countries:—Argentine, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Colombia, Cuba, Ecuador, Greece, Netherlands, Netherlands East Indies, Norway, Peru, Spain, Sweden, and Venezuela.

Coal Shortage in Germany.—The "Daily Chronicle" special correspondent at Amsterdam says that the gas question is becoming serious all over the Central Empires. Vienna has introduced a gasless 24 hours weekly. Berlin's population has been warned to exercise the utmost economy, as only very small supplies of coal are being obtained. In Stettin gas may only be used for 12 hours roughly out of 24, from 4.30 till 8 in the morning, from 11 to 1, and 4 to 11. Leipzig fares slightly worse, and prospects everywhere are dismal. The reduced amount of gas interferes seriously with various industries, and the situation will become worse shortly, when a reduction in the amount of electricity used is introduced, as is reported will be the case.

Economic War.—In the course of a discussion on war aims in the House of Commons last week, Lord Robert Cecil said (see *Times* Parliamentary reports, December 20th, 1917): —"An economic offensive was quite as important as, if not more important than, any other aim that we had. It was perfectly right to 'bomb' German businesses. The policy of the 'statutory list,' which enabled them to do their best to put out of business German firms in neutral countries, had been one of the main instruments in weakening the economic power of Germany, and in making her look anxiously to the restoration of peace. Neither he nor any other member of the Government advocated an economic war after the war. There was in many respects a world shortage of raw material, and the longer the war lasted the greater would be the shortage. The country would have a right to impeach any Ministry which allowed this country to be in want of essential raw materials because they were being sent to those who had been our enemies in this war. There was nothing vindictive about that. It was a statement of economic fact which it was right to present to the world."

Germany's After-war Trade.—The Central Union of the German Wholesale Trade has issued a series of 20 essays, urging the importance of preparation for the transition period following the conclusion of peace. Imports, it is pointed out in one of these, will involve the payment of large sums to foreign countries. The wholesale trade, however, can make use of its own connections to obtain credit so that payments will be better regulated and more widely distributed. At the same time an effort should be made to export, as far as possible, goods of a high value, such as potash and dyes, whereby credits may be obtained abroad. The problem would be greatly simplified by setting aside a large amount of gold for the use of the importers, if that can be done without injury to the German economic system. Purchases abroad should be made through syndicates, consisting of representatives of both industry and the wholesale trade, and the Government should exercise a certain control over prices. So the Germans propose—but the Allies may dispose otherwise.—*Financier.*

Exemption Applications.—At the Lanarkshire Military Appeal Tribunal, the head electrician at the Royal Princess Theatre, Glasgow, B 2, was granted exemption until the end of the pantomime season. He was stated to be the only practical electrician on the staff. He had charge of the network of electrical appliances on the stage, and he had eight unskilled workers under him. It was stated that it would be a source of danger to the public if he were taken. He is not to be called up until March 1st.

The Bispham-with-Norbreck Urban District Council appealed to the County Appeals Tribunal, at Preston, against the decision of the local Tribunal, which refused more than two months' exemption to their electrical engineer, on the ground that it was unreasonable to expect to retain two Class A men for the work. The Chairman asked if it was not possible for the Blackpool Corporation to take over the electrical supply of Bispham in advance of the date agreed upon for the amalgamation of the two areas. The reply was in the negative. The County Tribunal therefore granted temporary conditional exemption to March 31st, by which time winter lighting would be over, and amalgamation would have taken place. It was intimated that the Council would then want a much stronger case to gain any further consideration.

At Skipton, an Addingham electrician and engineer had his appeal refused, and was ordered to report for service on January 1st, with a strong recommendation that he be allocated to the Air Service, which was badly in need of such men.

Before the Essex Appeal Court, the Union Cable Co., Ltd., of Dagenham, appealed for H. Comley (20, Class A), cable machine help; W. H. Rowe (23, Class A), cable armouring machine help; C. W. Dean (24, Class A), lead-press help; G. E. Wheeler (20, Class A), cable armouring machine help; A. W. Taylor (24, Class A), help to cable vulcaniser; W. Matson (24, Class A), lead-press hand; and R. Thorpe (19, Class A), cable machine hand. Mr. Blackwood, the firm's representative, said that it had been found impossible to obtain substitutes. If the men had to go, the work would have to stop. The Military Representative pressed for Comley, Matson, Thorpe, and Taylor, as the Dilution Officer was of opinion that they could be spared. Substitutes had been offered, but had not been accepted. Rowe, Dean, and Wheeler were not pressed for, their claims having been accepted by the Dilution Officer. Mr. Blackwood said that he could not accept the substitutes on the terms under which they were offered. He could not spare any of the men. Mr. Hollick thought that someone who understood the work ought to decide whether or not it was necessary. If it was not necessary, all the men ought to be in the Army, and if it was necessary older men who were accustomed to the work might be brought out of the Army as substitutes. Conditional exemption was granted in each case until efficient substitutes were found, when the cases could be reviewed.

Before the South Yorkshire Appeal Court, the Military Representative appealed against exemption held by Mr. A. B. Gott (35, B 1), electrical engineer, and the exemption was cancelled.

At the Shoreditch Tribunal, S. J. Minter (26, single, C 1), managing director of Stuart (Woodworkers), Ltd., made a third application on business grounds. It was stated that they were now doing a large business in electrical goods, with an ever-increasing trade. At one time the business was run by a man named Baber, and some time back the Tribunal agreed that as he was an A man he could join up, and this man Minter could carry on. This he had done very successfully, the business at the present time being a great success. Captain Weber said the arrangement that this man should stay and carry on was a legacy from a very reprehensible practice of theirs of some time back. Nobody dreamed the war was going to last so long, and they allowed these things. The Chairman said they had been ordered to take all fresh conditions into consideration, and there were clearly fresh circumstances here. The Tribunal decided to grant one month only, final.

At the Shoreditch Tribunal, on Friday, Messrs. W. A. and R. J. Jacobs, Ltd., electricians and electric torch manufacturers, applied that the condition of exemption as to his doing V.T.C. drill should be waived in the case of W. J. Bristow, the manager. He was classed C 3. Owing to the heavy pressure of important work, he was unable to do any drilling. They were under the impression that he was not liable in view of the low medical category. The Tribunal declined to take any action in the matter.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Production of Ductile Tungsten.

In the lecture given by Mr. Sydney Johnstone at the London School of Economics on the subject of the Rarer Key Metals, as published in the December 2nd issue of the *Daily Telegraph*, the following statement is made with reference to tungsten :—

"A small quantity is employed for the production of filaments for incandescent electric lamps. The manufacture of ductile tungsten for this latter purpose was not carried on in this country before the war."

Mr. Johnstone has evidently been misinformed on this point, because the British Thomson-Houston Co. were supplying their whole requirements of ductile tungsten for Mazda lamp filaments in 1912 by manufacture at their Rugby works. At that time, and until within a month or two from the date of the outbreak of war, the raw material used was tungsten oxide; but the company, foreseeing a possible shortage of that material, at the outbreak of the war, immediately started the manufacture of the metal from the raw ore.

This ore, which is of British origin, has always been available in sufficient quantities to supply the needs of the lamp industry. The metal required for tungsten lamp filaments must be of an exceptional purity—far higher than that required for steel alloys—so that the method of refining involved a considerable amount of research and development work before it could be put into regular operation on a commercial scale. This was successfully accomplished, and the whole process of refining the ore and producing ductile tungsten filaments from the metal obtained has now been continuously in operation since the middle of 1915, and many millions of feet of wire have been made.

The British Thomson-Houston Co. not only takes care of its own requirements, but supplies filament for lamps made by a number of its licensees. It has sufficient capacity for supplying far more than the requirements of the lamp industry of Great Britain, if needs be.

Trusting that you may be able to find space for this letter in an early issue.

The British Thomson-Houston Co., Ltd.
(Patent Department.)
JOHN GRAY.

London, E.C., *December 19th*, 1917.

Distinctive Colours for Braided Cables.

I have often wondered why the colour of the braiding of electric cable is either red or black. After years of experience, I think that if there were three colours of braiding, it would be of great service to "three-phase merchants."

As the electrical industry moves forward, three-phase plants and installations hold premier place. If a system of using, say, red, black, and yellow wire was followed, it would be an advantage in many ways. All wiring of machines, switchboards, and motor

circuits would be easily followed out, and wiring faults would be nearly eliminated.

In the case of star-delta connected machines and switchgear, three colours of wire would indeed prove beneficial. The leads from the machine would consist of two reds, two blacks, and two yellows. The mains into the switchgear would be one of each colour. In the connecting up of meters on three-phase work, three colours would be of great service. In house-wiring, &c., where the loop-in system is universal, the three colours would be greatly approved of. All feeds could be wired with red, returns with blacks, and switch wires yellow. In the wiring of three-phase automatic controllers, each phase would have its own colour throughout, and this would facilitate the tracing out of what is usually a maze of wiring. We all know the benefit of the various colourings of multicore telephone cable as used for, say, intercommunication systems. Without wishing to have a multitude of colours, I do think that if another colour were added to the V.I.R. cables it would indeed be useful. The colour I suggest is yellow.

I trust that some of your readers will state their valued opinions on this matter.

T. D. Spark.

Newcastle, *December 4th*, 1917.

BUSINESS NOTES.

Book Notices.—*Manual of Electrical Undertakings*, 1917-1918. By E. Garcke. Vol. XXI. London: Electrical Press, Ltd. Price 21s. net.—The Manual shows no disposition to shrink in proportions. It has arrived at its twenty-first birthday, and is putting on flesh still, judging from its bulkiness. The only change that war and rationing appear to have produced in regard to its general appearance is that its white paper has become grey, but this is not at all a drawback. It contains statistical and general information respecting 2,500 electrical undertakings. The aggregate capital issued by the electrical companies registered in Great Britain is stated at £475,400,320, which is about £5,000,000 less than for the year 1916-17, the reduction being due mainly to the exclusion of companies which are not entirely electrical or British, and to the redemption of debenture capital. There is a section dealing with electrical undertakings in the Colonies. The events of the year are reviewed, financial results of electric light and traction undertakings are summarised comparatively, there are 50 maps, a directory of officials containing about 20,000 addresses, and all the usual interesting features. The work has made its appearance later than usual, but it is stated that advantage has been taken of the additional period to insert various accounts and particulars of a later date than in previous years.

The International Mercantile Diary and Year Book, 1918. Edited by A. M. Pooley, B.A. London: Syren and Shipping, Ltd. Price 5s. net.—This interesting and useful annual, with the sub-title: "The Decimal Book," first issued last year, has been improved in many respects; the commercial information has been widely extended, and the convenient conversion and exchange tables have been expanded. Additions have been made to the tables for converting metric and British measures to other systems, and an explanatory article on the decimal system, by Mr. Harry Allcock, has been inserted. The ground covered by the contents is extremely wide and varied, and the arrangement is very convenient for reference. Anyone engaged in international trade should find the book invaluable.

We have received from the National Electric Light Association, U.S.A., bound copies of the Papers and Reports of the Fortieth Convention, held in New York City, May 9th-10th, 1917, including the following sections:—Technical and Hydro-Electric Section, Commercial Section, Electric Vehicle Section, General and Executive Accounting Section.

"Notes on Screw Gauges." By the Staff of the Gauge Testing Department of the National Physical Laboratory. Teddington: W. F. Parrott. Price 2s. 6d.

"Technologic Paper of the Bureau of Standards." No. 98. Effects of Heat on Celluloid and Similar Materials. Washington: Government Printing Office. Price 5 cents.

"Science Abstracts. A and B." Vol. XX. Part 11. November 30th, 1917. London: E. & F. N. Spon. Price 1s. 6d. each net.

"First Report to the Council of the North-East Coast Institution of Engineers and Shipbuilders on Certain Methods of Producing Vacuum." Newcastle-on-Tyne: The Institution. Price 1s. 6d.

"Tramways and Light Railways Association *Journal*." The December number contains a list of members and their addresses.

Trade Announcement.—With a view to centralising their business in London the Stanton Ironworks Co., Ltd., have opened an office at Maxwell House, Arundel Street, Strand, W.C. 2, and matters relating to their coal and cast iron foundry business will be dealt with there. Telegraphic address: "Cobbles Eastrand London." Telephone number: "Central 6808." Mr. Arnold Longden, who has represented the company for some years on the London Coal Exchange, will, during the period of the war, supervise the foundry section of the business in addition to the coal business. The Foundry Agency arrangement between the company and Messrs. Beck & Co., Ltd., has been terminated.

Tramcar Tires.—According to the *Journal* of the Tramways and Light Railways Association, the makers of tires for tramcars have announced that, in consequence of increases in the cost of labour, fuel, &c., the price of steel tires for tramcars for the first quarter of 1918 will be advanced 50s. per ton.

Lists.—WESTERN ELECTRIC CO., LTD., North Woolwich, London, E. 16.—Postcard executed in colour, showing the Western Electric "Quead" electric fires as cosy comforts for the children. Packets of the cards for correspondence purposes will be furnished to the trade on application.

Liquidation.—W. C. TACKLEY & CO., LTD.—This company is winding up voluntarily. Liquidator, Mr. W. Peet, 1, High Street, Croydon. Meeting of creditors January 2nd, at 27, Queen Victoria Street, E.C. 4. Particulars to be sent to Mr. Peet by December 31st.

NATIONAL PROVINCIAL ELECTRICITY CORPORATION, LTD.—Winding up voluntarily. Mr. S. Gillatt, Balfour House, Finsbury Pavement, E.C., Liquidator.

Proposed Industrial Bank.—A report has been issued by the Committee on Banking of the British Empire Producers' Organisation recommending a scheme for a proposed Imperial Bank of Industry.

The general motive of the scheme is to afford readier financial support on sound principles throughout the United Kingdom and the Overseas Dominions and Colonies for producers and manufacturers, and, amongst other results, it is intended that there shall thus be, in any event, no opening for German financial intrigue in obtaining control of any group of industry.

The available capital is to be provided in the shape of debentures and deposits with State guarantee. Further capital will also be accumulated by the funding of profits, as apart from a small bonus to debenture-holders and depositors, all surplus will remain in the bank. Provision is made for government by boards of trustees, on which both employers and employed would be represented. A guarantee and capital of 50 millions sterling is proposed, £25,000,000 guaranteed by the United Kingdom, £6,000,000 each by Canada and Australia, £2,000,000 each by New Zealand and South Africa, and £1,000,000 each by Newfoundland and eight Dependencies and Possessions. The objects are stated thus:—

To strengthen and to extend producing and manufacturing industries already established in the Empire.
To assist in the foundation and development of new industries therein.
To assist by credit facilities in the sale of their products.
To assist them in procuring materials, machinery, and facilities from other parts of the Empire.
To assist in the acquisition within the Empire by its citizens of control and utilisation of its own products.
The foregoing to apply only to companies, firms, and individuals of British origin, whose registration is within the British Empire.

The methods by which the bank would carry out its objects are:—

Making advances by way of cash credits against such security or guarantee as the trustees shall deem sufficient.
Accepting drafts made against shipments or deliveries of industrial products or of materials.
Buying and selling bills of exchange against collateral security.
Issuing letters of credit.
Discounting trade bills.
Purchase of secured time payment accounts or by advances upon the same.
To assist and co-operate with other financial institutions in underwriting the share and debenture issues of present or future industrial undertakings.
To collect and collate information likely to be useful to its customers.

Sterling Workers.—On Friday night and Saturday, at mass meetings of the night and day workers, who assembled in the canteen and new rest room, the managing director of the Sterling Telephone and Electric Co., Ltd., Mr. Guy Burney, who was accompanied by Mr. E. Cholerton (works manager) and Mr. A. W. Janes (assistant works manager), gave an address of encouragement and congratulation.

Mr. Len Evans, the honorary secretary of the Rifle Section of the Sterling Athletic and Social Club, has been the recipient of a Christmas gift from the members of the section.

During the past few weeks the employés of the Sterling Works, by voluntary collections for deserving objects, have subscribed over £200.

The members of the Sterling Ladies' Football Section (A.A.S.C.), who have gone through the first half of the season undefeated, made a Christmas gift to A. Coach.

LIGHTING AND POWER NOTES.

Bath.—The Electric Lighting Committee reports that an offer has been received for the purchase of the Diesel engine plant, but before making any recommendation the Committee has instructed the engineer to inquire if it is possible to obtain the plant he would require to replace the Diesel engine, if sold, in readiness for next winter's load.—*Bath Herald.*

Belfast.—LABOUR DIFFICULTY.—On the 21st inst., about 100 men in the Corporation's electrical department went on strike for what is now known as the "Hills' bonus." The strike caused some disorganisation in the lighting and tramway systems, for when the electrical employés decided to "down tools," the coal carters at once struck in sympathy. The lighting and the tramways are carrying on fairly under the circumstances. The electrical department is in communication with the Ministry of Munitions on the subject.

According to Monday's *Times* the dispute was settled on Saturday.

PLANT EXTENSION.—On the advice of Sir John Snell, it has been decided to scrap a turbo-generator at the power station, which has given considerable trouble. Fortunately, a big turbo-generator is, with the approval of the Minister of Munitions, to be released for the service of the Corporation. Its cost will be about £30,000, and with erection and supplementary plant, &c., the total cost will be about £60,000. The Electrical Committee is anxious to have the new power station at the harbour erected as soon as possible; as an alternative, it may be erected at the end of the Queen's Road on a site originally intended for a gas works.

Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that the Ontario Hydro-Electric Power Commission has now in hand preparations for the establishment of its extensive electric generating plant at Chippewa Creek, near Niagara Falls, Ontario.

The Commission is at present only engaged in transmitting electric power from producing companies at Niagara Falls to customers throughout the Province, who take the current and distribute it. With the establishment of the generating plant the Commission will be in a position both to generate and distribute power.

It is first proposed to construct a canal between Chippewa Creek and Queenston, Ontario, at an estimated cost of $9,000,000, after which the power house will be built and the plant installed. In view of the scarcity of labour and other considerations, the Commission has decided not to employ contractors, but will purchase the equipment necessary to carry on the work, and will undertake the construction of the plant as a public enterprise. The estimated cost of the equipment is $1,000,000.—*Board of Trade Journal.*

Dublin.—Wages.—At a special meeting of the Corporation it was agreed that the Electricity Committee should adjust on a satisfactory basis the application for increased wages by the technical staff of the electricity department. The Electricity Committee has decided to give the members of the engineering staffs the awards granted by the Committee on Production.

East Ham.—Price Increase.—The Electricity Committee recommends increased charges as follows:—Current supplied to general consumers (including public lighting), an additional 13⅓ per cent. upon pre-war prices, making a total increase of 33⅓ per cent.: current supplied to tramway undertaking, an additional 10 per cent. upon pre-war charges, making a total increase of 20 per cent.

Haslingden.—Bulk Supply. The Council has given notice to the Corporations of Accrington and Rawtenstall to terminate the agreement for the supply of electricity in bulk from December 31st, 1918.

Huddersfield.—Price Increase.—The T.C. has amended a minute of the Electricity Committee, so that the pre-war charges for electrical power and lighting should be increased to an amount to be decided from the date of the December readings of the meters.

Kidderminster.—Proposed Power Station.—At the last meeting of the T.C. the deputy town clerk laid before the members details of a scheme for erecting a large electrical power station on the banks of the Severn, at Stourport. A Bill, entitled the Worcestershire, Shropshire and Staffordshire Electrical Power Power Bill is being promoted, and Mr. J. A. Lycett, the managing director of the company, in a letter informed the Council that the station, when erected at Stourport, would be the largest power station in England. A member (Mr. Thursfield) said it was important that the progress of the Bill should be watched before Parliament. Ultimately the letter was referred to the General Purposes Committee.

Liverpool.—Dock Lighting.—The Mersey Docks and Harbour Board has under consideration a scheme for the electrical illumination of the dock estate.

Luton.—Plant Extension.—The T.C. is to consider a report from the electrical engineer upon the urgent need for extending the electricity station buildings, and providing additional plant to meet the increasing and prospective demand for electricity.

Manchester.—Wages.—As a result of the arbitration proceedings, the Corporation employés in the gas, electricity, water, and tramways departments will receive increases of from 12s. to 16s. per week as from January 1st next.

Rawtenstall.—Price Increase.—The T.C. has revised public lighting charges as from January 1st—viz., a standing charge of £5 per annum per kw. installed, plus secondary charges of 2d. to ½d. per unit, the latter for all above 60,000 units. Private lighting rates are also to be advanced 25 per cent.

Scarborough.—Price Increase.—The Electric Supply Co. announces that after the present meter readings the price of electricity for lighting will be 7d. per unit, for power 2½d. per unit, and for heating and cooking 1½d. per unit.

Southend-on-Sea.—Plant Extension.—The L.G.B. has informed the Council of its willingness to grant, when circumstances permit, the Council's request for sanction to borrow £15,520 for the provision of additional generating plant after the war.

Stratford-on-Avon.—Price Increase.—The General Purposes Committee has recommended by nine votes to four that the Electricity Co. be allowed to increase the price of current from 6d. to 6½d. per unit for the period of the war and a year after, and this has been ratified by the T.C.

Swansea.—At a recent meeting of the T.C., Alderman Martin moved for a reconsideration of the report of the Electricity Committee in regard to the proposed supply to the Harbour Trust, on the ground that the proposed terms would not be remunerative; this was denied in committee, Colonel Sinclair (chairman) and the borough treasurer both urging the advantage of securing the large consumers. The amendment was rejected by a large majority, and the report adopted.

Whitehaven.—Price Increase.—The T.C. has added a war charge of 20 per cent. in the price of current for lighting and power, from January 1st next.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Traffic Figures.—The Corporation tramway receipts continue to show remarkable increases. From April 1st to December 13th the receipts were £93,782, which is £12,749 more than last year, and considerably higher than in any previous year. During the past month the receipts per car-mile were 3d. more than last year.

Continental.—Spain.—Application has been made to the Ministerio de Fomento for a concession to construct an electric tramway between Mataro and Argentona.

East Ham.—Fare Revision.—It is proposed in the New Year to abolish return fares on certain routes, and the West Ham Council is to be approached with a view to abolishing return fares on through-running routes.

Halifax.—Wages.—The tramway employés have made application for a further increase of wages. The present rate is 15s. per week, with bonus, above the pre-war rate; if the application is granted the increase will amount to £1 per week above the pre-war wages.

Huddersfield.—It was resolved by the T.C., last week, that sailors and soldiers should not in future be allowed to ride free on the cars between 12 noon and 2 p.m. and 5 and 6.30 p.m. On the suggestion of the transport authorities the Committee would allow every facility for the carrying of tradesmen's parcels on the cars.

Hull.—Women Drivers.—The Tramways Committee has decided to appoint a number of suitable women as drivers for the period of the war, in view of the lack of efficient men drivers.

Lancashire.—A conference of a number of Lancashire tramway authorities was held at Manchester last week, but the men's representatives intimated that they would not accept the proposal of a modified service on Christmas Day, and they declined to submit any counter proposals.

Lancashire and Cheshire War Wages.—Over 20 Lancashire and Cheshire authorities are concerned in the award just made by the Committee of Production, on the application of the National Union of General Workers, for a further advance in wages, bringing them up to 20s. a week over pre-war wages. Previously a war bonus of 9s. was being paid, and the offer to raise this to 12s. was declined. The Committee has now granted an award of 7s. per week, making the pay 16s. a week, to commence in January.

Leeds.—A Committee has been appointed to consider the question of the alteration of stopping places and diversion of traffic on the several routes, so that the traffic may be more expeditiously got away from the centre of the city. The question is to be brought before the Ministry of Munitions at an early date.

London.—L.C.C.—Tramway Traffic Congestion.—At the last meeting of the Council the chairman of the Highways Committee said the congestion was due to shortage of material for repairs and shortage of motormen. Wherever possible, motormen were not taken for the Army unless substitutes were provided, but there was no prospect of getting men back from the Front. As to the difficulty at the Victoria terminus, the Committee had asked the Ministry of Munitions to help it in the laying of loop lines, but, owing to the objections of the Commissioner of Police, it was not considered advisable to carry out the scheme.

Women Drivers.—The Commissioner of Police is in communication with the War Office, Ministries of Munitions, Labour and National Service, on the subject of the issue of licenses to women to act as drivers of tramway-cars in the metropolitan district.

Rawtenstall.—Fare Revision.—The T.C. is to approach the B. of T. with a view to a general increase in tramway fares.

Snowstorm in the West Riding.—On Sunday and Monday the Huddersfield and Halifax cars only reached West Vale with the greatest difficulty, whilst at Keighley the railless traction service to Oakworth had to be suspended entirely on Monday.

TELEGRAPH AND TELEPHONE NOTES.

New Zealand.—According to the report of the New Zealand Post and Telegraph Department for the year 1916-17, there was a steady extension of telegraphic and telephonic facilities in that period. Forty new offices were opened, bringing the total number up to 2,409 on March 31st last. Ten new telephone exchanges were opened, and two closed. The telephone exchange

system includes 3,897 miles of line and 142,469 miles of wire. The working of the wireless stations continued to be satisfactory. Improved methods of detecting signals by means of the ultraudion were introduced at Awanui, Wellington, and at Auckland; apparatus for other stations has been procured, and will shortly be brought into use. The signals of stations using damped and undamped waves invariably come in of readable strength from American, Asiatic, and European stations. The use of the detecting apparatus with a particular combination of the receiving circuits has demonstrated that daylight signals from stations using the ordinary wave-lengths can be rendered plainly audible, which, by the ordinary methods and the use of the crystal detector, could not be heard.—*Financial Times.*

Holland.—The firm of Siemens-Schuckert has just entered into a £416,500 contract with the Netherlands Government for the installation of a wireless telegraph service between Holland and the Dutch East Indies.

Poulsen Wireless System.—The Italian Government has taken over Valdemar Poulsen's Wireless patent. The owners of the Italian patent are a group of English financiers.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd, 1918. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-KW. turbo-alternator with condensing plant. See "Official Notices" December 7th.

Keighley.—January 9th. Electricity Department. Induced draught plant. See "Official Notices" December 21st.

Manchester.—January 16th. Electricity Committee. Rotary converter or motor converter plant. See "Official Notices" to-day.

Tipperary.—January 11th. New battery for the Union electric lighting plant. See "Official Notices" December 21st.

CLOSED.

Government Contracts.—List of new contracts placed November, 1917:—

War Office.

Electric cables.—General Electric Co., Ltd.
Chassis, petrol and electric.—Tilling-Stevens, Ltd.
Dynamos.—Electric Construction Co., Ltd.
Generating sets.—Austin Motor Co., Ltd.; W. H. Dorman & Co., Ltd.; Electric Construction Co., Ltd.; Smart & Brown.
Rubber and insulating tape.—Ancoats Vale Rubber Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; C. Macintosh & Co., Ltd.
Iron wire.—Lancashire Wire Co., Ltd.; Rylands Bros., Ltd.; Whitecross Co., Ltd.
Works services electric lighting.—Edmundson's Electricity Corporation, Ltd.; Norris, Henley & Gardner, Ltd.

India Office.

Dynamos.—J. Stone & Co., Ltd.

H.M. Office of Works.

Engineering services electric light and power wiring, Avonmouth and Barry Docks Grain Stores, T. Clarke & Co., Ltd.; Cardiff Grain Stores electric light and power supply, Lund Bros. & Co.; New County Hall, Food Ministry, electric wiring, V. C. Middleton.

Post Office.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co. Ltd.; Peel-Conner Telephone Works, Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Testing apparatus.—Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph cable.—Craigpark Electric Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; New Gutta-Percha Co., Ltd.
Telephone cable.—Connolly Bros., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Telephone cords.—Siemens Bros. & Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.
Telephone mouthpieces.—Siemens Bros. & Co., Ltd.
Insulator spindles.—Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.
Cable suspenders.—T. H. Hangen, Son & Co.
Telephones.—Western Electric Co., Ltd.
Telephone terminals.—Parker, Winder & Achurch, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Enamelled and flame-proof wire.—C. Macintosh & Co., Ltd.
Galvanised iron wire.—Dorman, Long & Co., Ltd.; Johnson & Phillips, Ltd.; Rylands Bros., Ltd.; Whitecross Co., Ltd.

London.—Poplar.—The entry headed "Stepney" in our last issue requires correction. For *Stepney* read *Poplar*. The amount of Messrs. Bruce Peebles's tender was £3,850, not £3,580.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 28th. At 8 p.m. At 39, Victoria Street, S.W.1. Paper on "Water Circulation in Boilers," by Mr. H. Josling.
Friday, January 4th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Some Aspects of Lubrication," by Mr. H. E. Cosgreave.

Royal Institution of Great Britain.—Saturday, December 29th. At 3 p.m At Albemarle Street, Piccadilly, W.1. Christmas Lectures, "Our Useful Servants: Magnetism and Electricity"; "Electricity and Electric Currents" (II). Tuesday, January 1st, "The Electric Current as a Heater and Chemist" (III). Thursday, January 3rd, "Electricity as an Illuminator and Doctor" (IV). Saturday, January 5th, "Electric Dynamos, Motors, Transformers and Railways" (V), by Prof. J. A. Fleming, F.R.S.

ELECTRICITY SUPPLY ORGANISATION.

For some time past the future of electricity supply in Britain has been the *pièce de résistance* of British electrical journalism, and naturally so, for apart from the broader aspects of the matter, it must be recognised that any great extension of supply facilities will, with a moderate amount of business organisation, result in unparalleled prosperity to by far the most important section of the electrical industry. As regards the actual steps taken to secure this future, the past year or two has been marked by conference and negotiation, by a hopeful measure of co-operation, and not least by the realisation on the part of the Government of the invaluable character of the services which an adequate supply of electricity can render in promoting the prosperity of the nation.

It is at least certain that the various committees which have taken this matter in hand will amongst them evolve a scheme or schemes for the production and distribution of electricity on more advantageous terms and on a much more extensive scale than has been possible in the past—more one cannot say at present.

So much for the technical aspect of the matter, the importance of which will be granted. But what of the other side—the equally important question of providing the indispensable market for the commodity which we hope to see in universal use?

Can we claim to have made the slightest effort to secure the greatly extended outlet for the vastly increased amount of energy which should be available if our schemes mature, and on which, in fact, the maturing of such schemes absolutely depends? We think not; we are in effect preparing to hurry up production, while leaving sales to take care of themselves—an inconsistent procedure which will not commend itself to the commercial mind for one moment. The future of electricity supply absolutely depends on the commercial stability of the great undertakings which may arise from our present efforts; business in hand and business in prospect are essential to satisfactory finance; the business end of electricity supply, especially the potential demand for electricity, is the foundation on which all our schemes for the future depend. Yet we cannot point to any concerted action whatever by the supply industry of Great Britain, with a view to securing its position in this respect. The electricity supply situation at the moment appears to be as follows:—

Production of Electricity on a Large Scale.

We have the Board of Trade Electrical Supply Committee; the Interconnection Committees of Lancashire and Cheshire, Yorkshire, West of Scotland, South Wales, West of England, North-East Coast, Devon and Cornwall, &c., and the Provincial Electric Supply Committee, backed by the I.E.E., the Municipal Electrical Association, and the Associated Power Companies, working for the unification and co-ordination of supply by interconnection, bulk supply, and the utilisation of available waste heat sources, *to the end that an abundant supply of electricity shall be available for all classes of consumer in the United Kingdom.*

Sale of Electricity on a Large Scale.

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Let us make no mistake: if the schemes at present under consideration are ever realised, the electric supply industry of Britain will become the *greatest industrial organisation in the country*. A great and organised business will have to be developed from the initial stages represented by some hundreds of supply undertakings, which are isolated units as regards their commercial management, and have no effective organisation for the co-operative effort which is obviously indispensable to the success of the larger project.

Looking round at our potential business, we may say as regards :—

Lighting.—At the present time a generous estimate of electricity consumers is 2½ to 3 per cent. of the population supplied; the comparable figures for gas consumers are 25 to 29 per cent., so that there are, roughly, ten times as many consumers of gas. As we know that the majority of the latter are lighting consumers, it follows that we have only touched the fringe of the possible electric lighting business of domestic consumers.

Cooking and Heating.—Pioneering efforts have been fairly successful, especially with large installations, a recent estimate placing the latter at about 400 installations, of 22,000 KW.; domestic electric cooking, satisfactory, though in its initial stages, awaits co-ordinated effort and organised manufacturing and salesmanship; domestic electric heating has progressed with the rise in fuel values, but is only in the initial stage, while domestic water heating as a popular proposition is strictly a problem of the future.

Domestic Power.—Practically untouched; a very small motor, which is not a toy, and yet sells at a reasonable price, is badly needed.

[Generally, it may be said that the domestic consumer has been practically unexploited. Take an actual example: A consumer who used 400 units per annum for lighting, increased his consumption to 7,000 units a year, with electric cooking and heating, and thermal-storage water heating added, doubling his load factor and paying an average of ¾d. per unit, the rates being—l., 5d.; c. and h., 1d.; t.s., 0·3d.

The war has emphasised the importance of "domestic engineering" as a means of avoiding labour strain in the household. Due to the lack of initiative of the supply industry, the enormous advantages of electricity for light, power, and heating are not realised by the general public, while the architectural profession, on which much depends, has made no special study of the influence of electrical methods on domestic economy.]

Factory Driving.—This is the most progressive branch of electricity supply, but still offers immense scope for development, if Dr. Crowley's statement that only one-half of 1 per cent. of the power required by our textile factories is purchased from supply undertakings is any indication.

Mr. Robertson, at the last I.M.E.A. Conference, assumed that 13 million H.P. were employed in factories at the present time, and Mr. Selvey showed that if only half this were supplied electrically under average conditions, some 8,500 million units per annum would be required, which contrasts with the present output of all statutory undertakings, for all purposes, of 2,000 million units per annum. The result of intensive development of considerable areas, with concentrated and scattered coal, iron, and steel industries, can be judged from the work of the N.E. Coast power companies. As regards individual cities, we have a recent estimate from Leeds that nearly 40 per cent. of the power used in the city is supplied electrically; in Bury, a textile centre, Mr. Watson estimated that 20 per cent. of the power used was electrical.

In 1906, a canvass of factory power users in the County of London showed a total of 208,800 H.P., or 156,000 KW.; in 1913, Mr. Frank Bailey stated that the electrical power connections in that area amounted to 135,000 KW., or 86 per cent. of the foregoing amount.

Power estimates must, however, be treated with reserve; industrial power requirements are constantly growing, and factories show a tendency to move outside town areas.

Industrial Heating.—In its initial stages: it was estimated that 90 electric steel furnaces were in use in January, 1917, as against 7 in 1910. [It is stated that the electric furnace load at 51 steel mills in the U.S.A. accounts for 300 million units per annum.] Industrial low-temperature heating for baking, drying, annealing, tempering, melting, &c., also for electric welding, brazing, &c., offers great possibilities for development, and is little appreciated as yet in this country.

Electrochemical Work.—An established industry on a small scale; modern views on the development of the carbide, nitrate and other chemical industries will, if they materialise, lead to an unprecedented expansion of electricity supply for such purposes in the future, if the price of energy can be brought low enough.

Electric Tramway Traction.—Offers little scope for development, under present legislative conditions.

Electric Railway Traction.—One of the most important fields of future electrical development; partial suburban electrification at London, Manchester, Liverpool, and Newcastle; no main line electrification yet undertaken.

Electric Vehicle Traction.—In its initial stage. About 1,000 vehicles in use, or on order, as against 150 in 1914.

Offers enormous opportunity for development; progress due to organised effort of Electric Vehicle Committee of Great Britain, but its advantages still unrealised by the carrying public.

While we have only roughly surveyed the position, it is possible to deduce from it the fact that huge opportunities exist for future business in electricity supply; much of this business is, no doubt, a legacy of the *laissez faire* conditions existing in the electrical industry in the past, and the latter would, as a whole, have been incomparably better off to-day had initiative, enterprise, and patriotic support for its objects been more conspicuous features of its policy.

We shall never realise the progressive future which has been sketched out for us unless our electricity suppliers abandon the haphazard individual methods of the past, and adopt some common-sense proposal for establishing a community of interests, to develop their general business policy and popularise their dealings with the public.

The sale of electricity depends on the appreciation of the public, and the supply industry must realise that the latter is virtually in partnership with it, and demands to be taken into its confidence sufficiently to appreciate what it is doing and why it is doing it.

Now, while the private interests of the various elements composing the electricity supply industry in this country may not be reconcilable to any extent—and the petty jealousy of adjacent municipal authorities is quite as serious an obstacle to harmony as the rivalry of municipal and company interests—yet the business interests of all concerned, as regards their dealings with the public, present a sufficient similarity to justify the formation of a suitable organisation to give common expression to these common aims at least.

Whether this organisation is on the lines of the British Commercial Gas Association, or of the American Society for Electrical Development, or is a British counterpart of the more ambitious American National Electric Light Association, is immaterial at the moment, so long as an association is formed which is representative of the supply industry as a whole, for the purpose of directing and supporting the efforts of our undertakings to develop electricity supply with a view to the benefit of all.

We have in our midst several associations connected with electricity supply. If the strongest of these—for someone must make the first move—were to invite the others to join it in a preliminary discussion of the subject, this would serve, if no other purpose, at least to enlighten us on the peculiar conditions, which we have evidently overlooked, but which presumably exist, to prevent a great industry—the members of which have one common object in view—from adopting methods which every comprehensive industry finds it essential to adopt, and which, in fact, American central-station interests adopted many years ago in their dealings with the public.

It may be that there are still many in the industry with a limited outlook, many who do not realise that from little private plants, supplying a favoured few, our undertakings are growing into public utility corporations with responsibilities of a national character and Government interest behind them, whose business is not only the sale of energy but also to serve the public in all matters appertaining to electricity supply. To all such we appeal to take the broad view; it is the turn of the big town to-day, but it may be the turn of the small one to-morrow, if it offers the facilities and enterprise which are attractive to new industries. Above all, we would urge those engineers who favour the mole in their methods of dealing with the public to remember a certain old American saying that:

> He who whispers down a well
> About the goods he has to sell,
> Won't reap the gleaming, golden dollars
> Like him who climbs a tree and hollers.

Electric Postal Vans in Switzerland.—The Postal Authorities of Zurich have lately put in service a couple of electric motor vans, built by Messrs. A. Tribelhorn, of Feldbach, who are described as the only manufacturers of this type of automobile in Switzerland. Similar vehicles are also said to be in hand for the Postal Service in Geneva.

Electricity and the Growth of Crops.—According to the report of the Development Commissioners for the year ending March 31st last, among the grants made was one of £1,330 to the Imperial College of Science and Technology for an investigation into the effect of electrical discharge on the growth of crops.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 81 of the ELECTRICAL REVIEW, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to: The Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Educational.—BIRMINGHAM UNIVERSITY.—At the annual distribution of certificates at Warwick School, Sir Oliver Lodge, in congratulating the successful boys, said he was much impressed by the almost luxurious provision in the school for the teaching of chemistry and physics. He hoped this development in scientific instruction would, among other things, blossom in the application of science to agriculture, for the teaching of which there would shortly be a chair at Birmingham University. The one thing that had been neglected in this country was the scientific and thorough cultivation of the land, with the aid of which the country might nearly feed itself. He hoped Mr. Fisher's Education Bill would be passed without too much delay, and that Mr. Fisher would deal with the Universities, because education needed to be reconstructed from top to bottom.

The A.E.G.—Apart from the political remarks on the general situation which Herr Walter Rathenau made, at the request of certain shareholders, at the recent general meeting of the A.E.G., very little information of external interest is reported in the German newspapers as having been laid before the assembly. As in former years, a small minority condemned the accumulation of such large disclosed and undisclosed reserve funds, it being urged that a higher dividend than 12½ per cent. should be paid, seeing that at the present quotations the shares only yield about 5 per cent. The question of the disposal of the large interests held in the Electro Works was explained by the chairman at some length, and the impression to be formed from his observations, is that if the company has made some financial sacrifice in transferring the undertaking to the Government, the directors are glad to be relieved of what had become a burden under the effects of the war. A third matter referred to was raised by a representative of the staff, who advocated the grant of an increased war bonus to the employés, but the chairman ruled that the subject could not be discussed in general meeting, as it was one for the managers and the Committees or the Conciliation Boards. The political part of the chairman's speech closed with the remark that "our foreign business lies in strong hands in which we trust." Such an observation was undoubtedly true all over the world prior to the outbreak of war. It is, we believe, none the less true now in so far as neutral countries are concerned, particularly in South America, owing to the formation of native companies, the German interests in which it will be difficult for transmarine States to eradicate, if they are fully disposed to take this step in those cases where South American countries have recently joined the Allies or discontinued diplomatic relations with Germany.

Magneto Flash Lamps.—Referring to our article on this subject, published on October 26th, Mr. F. Westmoreland, from whose article in the *Model Engineer and Electrician* we obtained the illustrations of an actual example, points out that the drawings were made and supplied to him by Mr. Thos. Hindle, of Manchester, the owner of the lamp. We understand that the question of manufacturing such lamps in this country is under consideration.

The Effect of Heat on Celluloid.—A new publication of the U.S. Bureau of Standards (Technologic Paper No. 98), entitled "Effects of Heat on Celluloid and Similar Materials," contains a study of the behaviour of celluloid, and of pyroxylin plastics in general, when heated to different temperatures, commencing in the neighbourhood of 100° C. Above this temperature the heat of decomposition may raise the temperature of the mass to the ignition point. At 170° C. decomposition takes place with explosive violence. Pyroxylin plastics can be ignited by momentary contact with bodies having a temperature of 430° C. and upwards. The rate of combustion is five to ten times that of poplar, pine, or paper under the same conditions. The vapours evolved during the decomposition of pyroxylin plastics are poisonous and extremely combustible, and may be ignited by the heat of decomposition. A copy of the paper may be obtained by those interested by addressing a request to the Bureau.

Tracing Linen for Bandages.—Understanding that tracing linen used for plans is useful for bandages for wounded soldiers, Westminster City Council has authorised the engineer to go through the old plans and dispatch to the hospitals any old tracing linen of no further use as official records.

Many of our readers are probably in possession of large quantities old tracings which could thus be usefully turned to account.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending January 5th, 1918, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Lieut. C. E. Campbell.

Next for Duty.—Lieut. W. J. A. Watkins.

Monday, December 31st, 1917.—No. 3 Company, 6.30—8.30. Recruits' drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, January 1st, 1918.—Lecture on "Demolitions," 6.30, by Capt. Fleming. Physical drill, 7.30.

Wednesday, January 2nd.—No. 1 Company drill, knotting, and lashing, 6.30—8.30. Recruits' drill, 6.30.

Thursday, January 3rd.—No. 2 Company drill, knotting, and lashing, 6.30—8.30. Recruits' drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30. Medical examination of recruits, 6.30—8.30.

Friday, January 4th.—Musketry, 5.30—8.

Saturday, January 5th.—Entrenchments, &c., 2.45—4.45. Recruits' drill, 2.45—4.45.

Sunday, January 6th.—Commandant's parade at Waterloo Station (opposite No. 10 Platform), 8.45 a.m., for work at Esher. Uniform, haversacks, and water bottles and mugs. Mid-day rations to be carried.

Note.—All drills and parades will be at Headquarters unless otherwise stated. Recruits will attend for engineering instruction with the companies.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Communication with Aircraft.—It is reported that the French Army has recently introduced a novel form of miniature searchlight, operated by electricity and equipped with a telescope. When in use the searchlight is held in the hands of the operator, so as to bring the telescope into sighting position. The searchlight is aimed at the aircraft with which communication is to be established and maintained, and the operator then sends the messages by means of a tapping key on the side, causing long and short flashes of light to spell out the words or numerals in the telegraph code used. By means of the telescope the operator is able to see the distant flashes of the answering searchlight, and in this manner two-way communication is maintained as long as desired. The new signalling equipment is light in weight, consisting of but the searchlight and battery, and therefore readily portable.—*Aircraft.*

A Hut for Signal Service Officer Cadets.—The Administration Officer at the Headquarters of the Signal Service Officer-Cadet Company, R.E., Lieut. F. S. Paterson, R.E. (late of Messrs. Johnson & Phillips) informs us that the present establishment includes Canadians, Australians, South Africans, and men from other parts of the world, as well as from the British public schools. During his course the Officer-Cadet has to become technically efficient, besides undergoing a strenuous training, and there is an urgent need for accommodation to enable the Cadets to study during the evenings and the week ends, as the technical knowledge of modern methods and apparatus for communication that they must acquire is very extensive and detailed. Lieut. Paterson, therefore, appeals for a hut for, say, 100 Cadets, with a suitable equipment for the purpose described above. The Signal Service Officer-Cadet Company is closely associated with the electrical industry, and its members are worthy of the strongest support. We earnestly commend the matter to the notice of our readers, especially those engaged in the instrument and cable-making trades, to whose sympathies the project should appeal. Lieut. Paterson's address is Cadet Company, R.E., Haynes Park, Bedford.

Institution and Lecture Notes.—Royal Institution.—The official list of lecture arrangements up to Easter, 1918, has been issued, and contains announcements of the following events:—

At 5.30 p.m.

Friday, January 18th.—"Studies on Liquid Films," by Prof. Sir James Dewar, F.R.S.

Friday, January 25th.—"The Motion of Electrons in Gases," by Prof. J. S. Townsend, F.R.S.

Friday, February 8th.—"Science and Ethics," by Principal E. H. Griffiths, F.R.S.

Friday, March 8th.—"Vibrations: Mechanical, Musical, and Electrical," by Prof. E. H. Barton, F.R.S.

Friday, March 22nd.—"Radiation from System of Electrons," by Prof. Sir J. J. Thomson, Pres. R.S.

At 3 p.m.

Tuesdays, February 26th and March 5th.—"The National Physical Laboratory: (1) A National Laboratory of Industrial Research; (2) A National Proving House and Standardising Laboratory," by Sir R. T. Glazebrook, F.R.S.

Saturdays, January 19th and 26th.—"The Chemical Action of Light," by Prof. W. J. Pope, F.R.S.

Saturdays, February 16th, 23rd, March 2nd, 9th, 16th, 23rd.—"Problems in Atomic Structure," by Prof. Sir J. J. Thomson, Pres. R.S.

The first of the series of six Christmas Juvenile Lectures on "Our Useful Servants: Magnetism and Electricity," was delivered by Prof. J. A. Fleming, F.R.S., yesterday afternoon.

Institution of Electrical Engineers.—A meeting of the NEWCASTLE-UPON-TYNE LOCAL SECTION was held on December 18th, the chairman, Mr. A. H. Marshall, presiding. A reception was held by the President of the Institution, Mr. C. H. Wordingham, who was supported by Mr. Marshall, and, subsequently, the President addressed the gathering. After having thanked the members for their very cordial reception, he said he felt that it was desirable that the Local Sections should be cognisant of what was going on in London. There was a persistent tendency on the part of a section of the electrical Press to belittle the Institution, which he did not think was conducive to its best interests, but was rather mischievous. Constructive criticism was a good thing, and there was nothing he liked better than honest criticism, but when they saw the Council of the Institution always attacked, and it seemed that it could not do right, there grew up a feeling which spread like a canker, and the members felt that the Council was no good. The influence of that section of the Press was not beneficial, but undoubtedly mischievous. If the Institution were to progress, they must have loyal support. They had seen various organisa-

tions go ahead, and he thought the reason for it was to be found in their extremely pushful policy. That Institution could not afford to sit down and wait for something happening, but must go ahead. At the present time, if they wanted to deal with any question they were not able to command the whole of the sections of the industry; he did not know why, but they could not. It was, therefore, necessary to get them together. He felt it was essential to carry all sections of the industry in anything they had to do. In adopting such a pushful policy they must take risks, but nothing was more deadening than the feeling that they must not attempt so and so because "it might fail"; or because "years ago they had tried it, and it had failed," or because some questioned its wisdom—they must take some risks. The first step, he thought, to a wider influence, and a better position, was to obtain a Charter. He referred to that in his inaugural address, and he found he had the Council with him. If they could, they would go in for a Royal Charter. Referring to some of the activities of the Institution, and speaking of research work, the President said the question of insulating materials had been before them even before the war, and the outbreak had greatly emphasised the need of research upon this question. A Joint Committee had been formed of three members of the B.E.A.M.A. and three of their members, and their harmonious efforts were making steady progress. The relations between their Research Committee and that of the B.E.A.M.A. were wholly cordial. He had suggested the appointment of a research organiser, a man of scientific training, with engineering experience, whose function would be, not to interfere with anything that was existing, but to act as a go-between, to co-ordinate the work, and to give some impetus to it. It was impossible for the chairman of the Committee, or for the permanent officials, to give the time that was needed. The research organiser would see that the research workers had the facilities they required, and the materials they required, in proper form and carefully prepared. There had also been a good deal of hard work done with regard to standardisation. This included high-pressure switchgear, and he thought it would be most unfortunate if British standards were not fully borne in mind. The purely British switchgear produced in that neighbourhood had set before it a maximum ideal of switchgear. The margin of safety was greater than in general practice, but either that margin of safety was necessary or not, and in that connection a great deal of research work was required. He thought it would be an excellent idea if there could be set up in that district an Advisory Committee able to undertake research work into switchgear, with a view to advising the Committee on this matter. The President concluded with a reference to the desirability of the establishment of a Proving House, which would only give its hall-mark to gear produced by British makers, and which would show that that type of article had conformed to the standards laid down by the Standards Committee. The President was cordially thanked for his address, on the motion of Mr. H. W. Clothier.

Association of Mining [Electrical Engineers (West of Scotland Branch).—On Saturday, January 12th, Mr. J. H. C. Brooking will read a paper on "Cable Complaints." There will be a display of cable joint-boxes and a demonstration of repairing of cab-tire trailing cable.

Appointments Vacant.—Shift engineer, for the Lancashire Electric Power Co. (£17 per month); Head of the Electrical Engineering Department of the Loughborough Technical Institute (£220 + £30 war bonus); mains assistant, for the Borough of Dover Electricity Department; district electrical engineer, for the War Department, South Irish District; teacher for the training of disabled soldiers in electrical work (£4) for the Middlesex Education Committee. See our advertising pages to-day.

A Novel Use for a Motor-Car Electric Lighting Set.—The testers at the Fiat Motor Works in Turin, Italy, have discovered a new use for the electric lighting sets on motor-cars, which will doubtless be of interest, and serve as an example, to car owners in this country. These men are called upon to test cars in extremes of weather and temperature, and as motor chassis under test cannot be fitted with wind-screens, the problem of keeping warm while driving on Alpine roads is one of no small order. The Fiat testers are now, consequently, being supplied with electrically-heated gloves, the necessary current being drawn from the electric lighting equipment on the car. The gloves have resistance wires set in the back, between two layers of thin sheet asbestos; connection is made to the electric light terminals at the most convenient points, and the fine flexible wires are attached to the wrist of the gloves by means of press-on buttons. The wires are of sufficient length not to interfere in any way with driving, and the current passing through the resistance is said to keep the hands at a warm temperature even on the coldest day. When it is necessary for the driver to leave the steering wheel of the car, the wires can be instantly disconnected from the gloves merely by a pull on the press-button connections. A similar method of obtaining warmth has been adopted by military aviators, whose clothing is now electrically heated on much the same plan.

The Functions of a Borough Electrical Engineer.—As we go to press we have received the following letter:—

"My attention has been called to a letter in your last issue purporting to be signed by Mr. H. Brand, and headed 'The Functions of a Borough Electrical Engineer,'

"In fairness to the borough electrical engineer, the public should know the true facts, which are as follows:—

"My company had an inflated claim made against it by Mr. Brand, who, when he could not get his exorbitant demand satisfied, issued a summons in the East Gravesend County Court

"The matter, on behalf of the company, was placed in the hands of Mr. George Clinch, solicitor, who advised a quite reasonable amount being paid into Court, and that a subpœna should be issued for the attendance of Mr. McInnes as an expert. This was done, and Mr. McInnes was served, and therefore was bound, under a very heavy penalty, to attend. He had no option.

"The judgment shows very clearly what the Judge thought of Mr. Brand's claim.

"ARTHUR GREEN,

"*Manager and Secretary, Grand Theatre of Varieties (Gravesend), Ltd.*

"Gravesend, *December 21th*, 1917."

[We are pleased to publish this letter, which gives an entirely different aspect to Mr. McInnes's connection with the case. We may add that, according to our present information, far from knowing "absolutely nothing of the case," Mr. McInnes was consulted by the theatre company as to the working of certain electrical apparatus, and advised the company as to the repairs that were necessary, before the work was entrusted to Mr. Brand; he was, therefore, fully conversant with all the circumstances and in a proper position to give professional evidence as to the facts.—EDS. ELEC. REV.]

Explosion at Krupp's Power Station.—Press dispatches from Holland state that an explosion which occurred at the electric power station at Krupp's, at Essen, seriously damaged the building, also that the works were set on fire.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—At a meeting of the Birmingham Electric Supply Committee on December 19th, MR. ERNEST JOHN JENNINGS, the secretary of the St. Marylebone electric supply undertaking, was selected to be recommended to the City Council at their meeting on January 8th for appointment as secretary of the electric supply department, in succession to Mr. Howard Foulds, who leaves at the end of the year to take up his new position in London. There were 266 applicants for the post, and three candidates were interviewed by the Committee. Mr. Jennings, who is 46 years of age, has held his present position at Marylebone for 13 years. Previously he was in the employ of the St. Pancras electricity undertaking. At the same meeting the Lord Mayor presented to MR. FOULDS a copy of the following resolution, engrossed on vellum, and signed by the Lord Mayor and the chairman of the Committee:—

Resolved unanimously, that the Electric Supply Committee of Birmingham receive with great regret the resignation of Mr. Howard Foulds as secretary of the electric supply department, and desire to place on record their high appreciation of the energy, ability, and tact with which he has successfully performed the duties of that office since his appointment, which has covered a period of over seven years. This period has witnessed an exceptional development in the operations of the electric supply undertaking, first, owing to the extension of the city and the absorption of the Aston Manor and Handsworth electric supply undertakings, as well as carrying the operations of the department into a large portion of the areas of Yardley and King's Norton; and, secondly, owing to the exceptional demand for electrical energy which has arisen during the progress of the present war. The work that has fallen upon the shoulders of Mr. Foulds has been heavy and responsible, and the Committee are pleased to recognise that he has fulfilled the demands made upon him to their complete satisfaction; they consider that the department has gained in efficiency by his efforts, and he will leave behind him a record of work which will be remembered and appreciated by the Committee and his colleagues, and they assure him that he enters upon his new appointment with their best wishes for his future prosperity.

Ilford U.D.C. has confirmed the engagement of MR. W. GREENWOOD as temporary third engineer in charge, at £150 per annum and war bonus.

The Heston and Isleworth E.C. recommends that the salary of MR E. W. JAMES, power station engineer, be increased to £250 per annum, rising by annual increments of £25 to £300; and that MR. T. W. GANDER, mains foreman, be granted an increment of £12 10s. per annum, with subsequent increases of £12 per annum to a maximum of £200.

MR. RUDOLPH THOMSON, shift engineer at the power station of the Lancashire Electric Power Co., has been appointed charge shift engineer at the L.C.C. generating station at Greenwich, at £250 per annum, rising to £300 per annum.

Barnes U.D.C. has increased the salary of the assistant electrical engineer to £300 a year, plus a war bonus of 7½ per cent. per annum.

MR. J. RENSHAW, of the Bury Corporation electricity works, has been appointed chief assistant at the Fleetwood electricity works.

It is announced in the *Financial News* that MR. F. DUDLEY DOCKER, C.B., of the Metropolitan Carriage, Wagon, and Finance Co. Board, has joined the directorate of the British Westinghouse Electric and Manufacturing Co., following the financial interest taken by the Metropolitan Co. in the British Westinghouse Co., whose American-held shares the first-named company lately acquired.

MR. J. W. DARLING has resigned his position with Messrs. Jonas Brook & Bros., Meltham Mills, and has joined the staff of Messrs. John Baker & Co. (Rotherham), Ltd., at Kilnhurst Steel Works, as electrical engineer.

General.—The *Times* announces the engagement of Lieut.-Colonel Arthur Fawcus, M.C., second son of the late Mr. James Fawcus, to Miss Alexandra James, of West Dean, Chichester.

Mr. C. J. Hunt, chief engineer to Messrs. Bruce Peebles & Co., Ltd., was married on 22nd inst. to Miss Marion V. Lambert, of Edinburgh. Mr. Hunt was presented with a case of cutlery by the officials and staff.

Roll of Honour.—Rifleman H. Allen, 11th K.R.R., served his apprenticeship in the composing department of the Electrical Review, in which he was employed continuously for a period of 16 years. He fell in action on September 20th, 1917, aged 29 years. He was an ardent supporter of the (B.P.) Boy Scout movement, being mainly instrumental in founding the 41st South London (Rangers Own) Troop, and their first Scoutmaster. He was of a quiet and unassuming disposition, and his loss is much regretted by all who knew him. In a letter to his relatives an officer of his unit comments on his bravery and on his popularity amongst his comrades.

Acting-Captain and Adjutant V. C. Russell (Suffolk Regiment), younger son of Mr. Stuart A. Russell, works manager of the India-Rubber Co., Silvertown, has been awarded the Military Cross. Early this year, Captain Russell (then Second Lieut.) was wounded for the second time. He had then been twice mentioned in dispatches. Private A. E. Haffenden (Lancashire Regiment), formerly in the general office of the same company, was killed in action on October 22nd. Private E. T. S. Morris (London Regiment), of the same department, has been gassed.

Lieut. W. H. Gouldstone, R.F.C., who has been mentioned in dispatches by Sir Douglas Haig, was up to his enlistment in the Navy, early in 1915, on the staff of the electrical engineer at West Ham. He served in the Dardanelles, and in August, 1916, was transferred to the R.F.C. He was recently wounded, and is in hospital at Eaton Square, W.

Sapper Donald Tee, R.E., who was on the staff of the Chichester electric light works, has been killed whilst engaged under heavy fire repairing a communication wire.

Corporal H. P. Arnold, R.E., who was in the turbine works of the B.T.H. Co. at Rugby, has fallen in action.

Private Frank Cornall, King's Liverpool Regiment, who has been wounded in action, was employed at Blackpool electricity works.

Flight Sergt. T. Harold Ames, R.F.C., has been gazetted Second Lieutenant. Enlisting early in 1915, he has seen active service in most of the air raids on the South-East Coast as gunner observer, being wounded during one. He was apprenticed to Mr. Thomas Barton, electrical engineer, Blackburn.

CITY NOTES.

Vera Cruz Electric Light, Power, and Traction Co., Ltd.

Mr. V. W. Yorke, in addressing the annual meeting, referred to the difficulties that had arisen in preparing the accounts. The two years which they covered had been the most difficult in the company's history. The net results showed a loss of only £702. During the entire period the exchange value of the Mexican paper currency continued to depreciate, but negotiations with the State authorities for increasing the tariffs and the tramway fares compensated to some extent for exchange losses. During the year 1916 the net earnings were some $12,500 higher than in 1915. It had not been possible to make any provision for depreciation of plant and machinery except for the operation of the first mortgage debenture sinking fund. There was a substantial figure to the credit of depreciation and general reserve account which had not been drawn on in any way. The company continued to receive its power from the hydro-electric plant of the Puebla Tramway, Light & Power Co., and except for intervals of short duration, when that company's transmission line had been out of service on account of the activity of rebels in the district, the supply had been continuous. In 1915 out of 6¼ millions kw.-hours consumed only 354,000 were generated by their own plant, and in 1916 out of practically the same consumption their own plant generated 415,000. The steam turbine plant, which was installed temporarily pending the completion of the Puebla Co.'s transmission line, had been disposed of on satisfactory terms. The company's property had been maintained in good condition, and many improvements had been made in the tramway tracks. New car barns, offices, and shops were in the course of construction, and many new ornamental posts for street lighting had been installed. Although the conditions of the country were by no means settled, the outlook for the current year was extremely satisfactory. All sections of the company's business showed improved results as compared with any year prior to the revolutionary disturbances. For the month of September this year, as compared with September, 1913, the total kw.-hours delivered had increased 29 per cent. The number of consumers of light had increased 110 per cent., and there was an increase in h.p. (in motors) connected of 52 per cent. In the tramways section the number of passengers carried had increased 70 per cent. to upwards of half a million passengers per month. The total gross revenue in Mexico showed an increase of 94 per cent., and although expenses were necessarily higher on account of increased wages, additional taxation, &c., the net earnings showed a satisfactory increase of 65 per cent. He was not without hope that when the accounts for this year were completed it might be possible to recommend a resumption of dividends on the ordinary shares. There were now very few enterprises in Mexico which had not been compelled, through no fault of their own, to defaults on their obligations during recent years, while this company had not only met the interest and sinking fund on its debentures out of profits as it had fallen due, but might now, unless the unexpected happened, return to a dividend-paying basis.

Richardsons, Westgarth and Co., Ltd.

A reorganisation scheme is under discussion. A circular has been distributed among the shareholders by the managing director (Mr. D. B. Morison), in which he replies to what he describes as "unfair and misleading" statements made in another circular which had been issued by a stockbroker and a shipowner of West Hartlepool. In the course of his statement Mr. Morison refers to the Contraflo patents as follows:—"The Contraflo patents were offered in the first instance to the company, but in view of the great speculative cost of developing world patents and the special expert staff involved, the Board decided not to exercise their option, but to retain their preferential manufacturing rights. The inventions were then developed by Mr. Morison and a few friends, and subsequently the Contraflo Co. was formed. Upwards of £50,000 have been spent to date in proving the inventions and developing the business, no part of which has been contributed by Richardsons, Westgarth & Co. The business is now of such importance that an agreement for the joint manufacture of certain Contraflo apparatus has just been entered into between Vickers and Richardsons, Westgarth & Co. which, asserts Mr. Morison, is calculated to largely benefit both companies."

According to the *Financial Times*, the reconstruction scheme was rejected at a meeting of preference and ordinary shareholders on Friday last, and a committee of shareholders is to confer with the directors with a view to formulating a scheme that would be generally acceptable.

The scheme proposed the reduction of the capital to £717,500 by reducing the value of the preference shares to 14s., and that of the ordinary to 7s.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

At the annual meeting, held on December 20th, Major Leonard Darwin, who presided, said that the net profits, after providing for doubtful debts and war contingencies reserve, amounted to £162,149, which had enabled them to restore another £50,000 to the reserve fund, which now stood at £450,000, the figure at which it stood before the first withdrawal in 1911. It was satisfactory to have entirely retrieved the losses made in 1911 and 1914. Regarding the £30,000 for an officers' and employés' staff fund, the question of instituting such a fund had been under the consideration of the board for some time, and it had also been in the minds of some of the shareholders. There was no doubt that after the war the necessity and usefulness of such a fund would become even more apparent and pressing, as doubtless there would be many cases arising as the result of the war which they were sure the shareholders would wish them to treat as generously as possible. To act thus would be impossible unless such a fund were now established. Hitherto the company had done nothing to provide such a fund for its employés, and considering the time the firm had been in existence, and the position which it held, they considered it most desirable that this omission should be rectified now that the opportunity had arisen. It was true that two of the past directors, Mr. Robert Gray and Mr. J. Y. Buchanan, had endowed a staff fund, which now amounted to over £9,000, but such a sum did not go far in the case of a firm which employed over 4,000 hands. Of course, the existence of this proposed fund would not constitute a claim for every employé, as such, to the proceeds of the fund. The directors, or the trustees whom they appointed to administer the funds, had entire discretion in its administration, for it would only be possible for a body thus constituted to obtain all the information necessary to ensure a wise distribution of benefits. The record of the year had been one of plentiful Government orders, and an equally plentiful supply of obstacles in the way of getting material and labour to execute them. The terrible explosion at Silvertown at the beginning of the year fortunately did little personal injury to their hands beyond a slight amount of damage from broken glass, &c., causing some interruption to work. They had made a claim against the Government in respect to this damage, and they hoped that it would shortly be liquidated. They heard last year of the loss of their remaining cable-ship, the *Dacia*. He stated then that the question of replacing her was engaging the attention of the board. To build a ship at the present time, when there were so many claims on the yards for tonnage, was, of course, out of the question. They might, no doubt, be able to purchase a ship of a kind not likely to be of much service for general freights, but which would

adequately fulfil their present requirements. Unfortunately, however, if they did so they would be left with a very costly ship on their hands for their future work in peace time. The foreign branches on the whole had done well, and Persan had made a good profit, in spite of the many difficulties in regard to labour and material, which were specially acute in France. All the company's available cash had been invested in War Loan and War Bonds, both of which were accepted in payment of Excess Profits Duty. They had lately been in correspondence with the Inland Revenue with regard to this duty on the profits on the year ended September 30th, 1916, and had accepted their assessment. As long as the war lasted they hoped to have plenty of Government work, but when Peace was declared an anxious period would be in store for all those firms who had lost much of their usual trade through the making of munitions. They had set aside a certain amount for those troublous days, but if, as might well happen, it should prove insufficient, they must hope that the Government would come to the assistance of themselves and other firms who had been put to disadvantage by the performance of national work. The extra profits from war work would assuredly have been sufficient to see them through all their future difficulties if they were not nearly all to be taken from them. He could not finish without again calling the attention of the shareholders to the excellent work done under most trying circumstances by their much depleted staff. They had done their utmost to meet the increased demand on their energy, and they had done this largely out of a spirit of patriotism.

Edison Swan Electric Co., Ltd.

Mr. C. Jermyn Ford presided, on December 19th, at the annual meeting. He said that the new capital, consisting of £100,000 preference shares, was issued in June last, shortly before the date of the balance sheet. Loans now stood at £44,000, against £27,000 at the date of the previous balance sheet. The reserve account now stood at £40,000, against £15,000 in the previous balance sheet, bringing it almost up to the same figure at which it stood four years ago, when the whole of the fund was applied in reduction of various assets then standing on the credit side of the balance sheet. They had expended £3,402 on new buildings, mainly in respect of additions to the lamp works, making them more efficient and capable of a considerably increased output, and they would possibly have to make a further considerable outlay on this part of the works. The item of "plant and machinery" had also increased by £7,500 for the same reason. Stocks had risen to the extent of £315,000, which was mainly due to the enhanced cost of raw materials, coupled with the increased price of labour upon that portion of this item which consisted of work in progress. Sundry debtors stood at £123,000, an increase of nearly £20,000, a large percentage of the total sum owing to them being in respect of Government contracts. With regard to the profit and loss account, at the first glance the results of the trading for the year might seem to be unsatisfactory, but during the past year the company had carried on its operations under probably the most disadvantageous circumstances which it could possibly have to face. It had been pointed out at every annual meeting at which he had presided, that the need of additional working capital was very seriously prejudicing the company's position, rendering it unable to take full advantage of any increased trading which it might obtain, and for the last few years the position had become steadily worse in this respect. During the year under review it arrived at its climax, therefore the earnings disclosed could not be a surprise to them. That portion of the new money brought in by the preference share issue, of which up to the date of the balance sheet they had received about £60,000, was not at their disposal until practically a few days before the close of the financial year, as the allotment of the shares did not take place until June 1st, and the balance sheet carried them to the 30th of that month. Under these circumstances, of course, they received no practical benefit from this money in the period; the only way it really benefited them was that they were able to clear off a very large amount of their outstanding indebtedness for goods supplied, &c., otherwise the item of sundry creditors would stand at a very much higher figure. This shortness of working capital had also affected them in two other ways; first, they had been unable to take full advantage of discounts on goods purchased, which they might otherwise have done had they been able to pay promptly for them, and he estimated that the losses under this head amounted to somewhere about £8,000; and secondly, they had not been able, for the same reason, to purchase these goods as advantageously as they might have done had they had the ready money to do so. Then the profits which would, under normal conditions, have been earned at the branches abroad, had been seriously affected by reason of the fact that it had been impossible to obtain shipping freights in order to keep these branches fully supplied with stock, and, whilst the current expenses abroad had increased, as everything had increased (a world-wide complaint), they had not been able to sell a correspondingly increased amount of goods, and, unfortunately, he did not think that this condition of affairs could possibly be remedied so long as the present difficulty of shipping goods continued. He told them last year that they had increased their operations in the Colonies, and that they were building up a good business there, but since then the question of shipping freights had become far more difficult than one could have foreseen The profit derived from the manufacture of electric lamps had also suffered, partly from the rise in the cost of labour and materials, and partly from the fact that a very large number of their old and skilled hands had left the works to take up the manufacture of munitions, and they had been forced to fill their positions with unskilled hands, whom they had had to train. This difficulty had for the moment been practically overcome, and the sale of lamps for the past six months had largely increased. The price of the lamp was only raised in May last, a month or two before the accounts closed, whereas during the whole period the costs of manufacture had increased by about 33 per cent., for the reasons before stated. Generally speaking, they had been manufacturing all classes of their products under very difficult conditions. They quoted prices based upon current rates of labour and raw materials, adding such a percentage as they were able to against the contingency of higher prices for labour and raw materials which might come into force before the contract was completed, but the constant demands of labour for increased wages and the incessant rise in the price of raw materials made it practically impossible to provide for all these contingencies when contracts were entered into, and the profits had suffered accordingly. In spite of the additional capital brought into the business by the preference issue, the cash position was far from being comfortable. Owing to war conditions and the heavy rise in all raw materials, a large amount of capital was required to run a business of this character, and, as their turnover had materially increased in recent months, they had to conserve their cash resources in every direction. The question of a small dividend payment on the ordinary shares was the subject of a good deal of discussion, and the board naturally were anxious to recommend one directly they could see their way to do so. Some might consider that, instead of carrying forward £13,266, they should apply a portion of this in the payment of a small dividend upon the "A" shares, but they must bear in mind that they still owed the bankers about £35,000, and it was incumbent upon them to reduce this as far as possible. Then they had over £7,000 to pay away shortly for munitions levy. On January 1st there was the interest upon the first debenture stock to be met, which amounted to about £7,700, and on February 1st there was the dividend upon the new preference shares, absorbing between £2,000 and £3,000. A dividend of only 2 per cent. upon the "A" shares would absorb £7,600, and therefore, under these circumstances, they had to go very closely into the cash position. They had suffered heavily during the last few years from the shortage of cash working capital, and now that they were getting into a better position it behoved them to be very careful that they did not run short again. For all these reasons they felt that, as regarded an immediate dividend, they must go a little slow, and they did not therefore see their way to recommend it at the present juncture. He trusted they would not consider that his was too gloomy a view of the position, but they must realise that all these facts, coupled with the great shortage of working capital which they had to face, made it impracticable for them to show better results. However, the new money had undoubtedly improved the position and earning capacity, and, with the very considerable increase in the output of lamps which they had now achieved, should make it possible for them, in the absence of unforeseen circumstances, to make a better showing for the current year. Practically the whole of the engineering side of the works had been, and was still, occupied with Government work. They had experienced a loss of profit of approximately £2,500 in consequence of having received no dividend in the past year on the holding of deferred shares in Altrincham Electric Supply. This concern suffered during the past year from the operations of the Daylight Saving Bill, and from general economies in use of current for domestic lighting purposes, and the high price of coal. He was glad to say, however, that this had now been to a great extent counter-balanced by some important contracts entered into for the supply of current for power purposes, and he was looking forward to far more satisfactory results for the current year. In regard to the question of the splitting of the existing £5 shares, which was fully set out in the scheme placed before them relating to the creation of the preference shares, an extraordinary general meeting would be held immediately following the meeting to sanction the cancellation of the remaining liability of £2 upon some of the partly-paid £5 shares, and should they pass the resolutions an application would be made to the Court at the earliest possible moment to obtain an order to confirm the reduction of capital, and at the same time the shares would be split into the denomination of £1 each.

Mr. E. B. Ellice Clark, in seconding the motion, said that with regard to the Munitions Levy of £7,295, the board considered it was not too strong a term to say it was an almost unjustifiable levy. The levy was based on pre-war profits, and as they knew, unfortunately for the company, for a few years before the war they were in low water, and made very small profits, and in one year they actually made a loss. The company voluntarily placed its resources at the service of the Government, which must interfere to some extent with its ordinary business, and they considered the levy was an exaction. They had to remember they were engaged in an industry which was of great service to the

country; whereas companies selling fripperies were making large profits, and were not called on to pay so much in view of the profits they were making before the war.

An extraordinary meeting followed, and the resolution dealing with the rearrangement of capital was carried.

Spanish & General Wireless Trust.—According to the *Morning Post*, Mr. Godfrey Isaacs presided at the annual general meeting held last week. He said that the Spanish business, in which they were very largely interested, was developing very satisfactorily, and a very substantial increase would be made to their producing powers in the early future. There was every reason to contemplate that the next twelve months would produce a very satisfactory balance sheet. In that case, there was reason to believe that it might be thought wise in Spain to declare a dividend. If this were done their Company—the Spanish and General—must benefit very substantially. The possibilities of business during the past year had been practically nil in consequence of the conditions which had prevailed. They did, however, continue some negotiations in Russia, where they considered a very substantial business would be done after the war, but in consequence of recent events the figures which related to their interest in this business stood in the balance sheet as "debtors and debit balances." That particular business had not been formally completed, and he dare not, at the present moment, express any opinion as to when it would be completed, or as to what would happen in Russia.

Costa Rica Electric Light & Traction Co., Ltd.—For the year ended June 30th, 1917, the net earnings in Costa Rica, after charging all expenses incurred, amount to £14,381, a decrease of £4,830 on the year. The net deficit is £3,827. This unfavourable result is chiefly due to the serious depreciation of the Costa Rica currency, the "Colon" only representing at present half its nominal gold value.

As all supplies have to be paid for in gold, the rise in the rate of exchange has automatically increased the expenses. The greatly enhanced cost of all stores, caused by the war, has also contributed to the decreased profits of the undertaking. In spite of the general depression in Costa Rica resulting from the stoppage of exports and dislocation of trade, the volume of the company's business has been maintained to an unexpected degree, and, but for the rate of exchange, would, even in the past year, have yielded a surplus after providing for all expenses. The power plant at El Brazil has worked well throughout the year. During the year the gold premium has averaged 200 per cent., as against 140 per cent. for the previous year.

Blackpool, St. Anne's & Lytham Tramways Co., Ltd.—The annual meeting was held at Blackpool last week, Mr. Geo. Nicolson presiding. The directors reported that necessary repairs would be carried out when labour and materials were available, and provision had been made on this account. The traffic receipts were £59,028, less £16,066 paid to the Blackpool Corporation, making the net amount, £42,962, and other receipts brought the total to £44,421. After the payment of expenses, there was a credit balance of £11,287. The directors recommend a distribution of the full year's interest of 5 per cent. on the debenture stock. The renewals account amounts to £10,727. In congratulating the shareholders upon the successful year's working, the chairman mentioned that practically all their available staff had joined the Army, and the cars were now entirely conducted by women.

Mr. C. H. Moore seconded the motion, which was carried.

Subsequently a resolution was passed authorising the directors to establish an officers' and employés' staff fund.

W. & T. Avery, Ltd.—Interim dividend on the ordinary shares of 5 per cent., less tax.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., equal to 1s. per share, less income-tax.

STOCKS AND SHARES.

Friday Evening.

The Stock Exchange broke up for its Christmas holidays with considerable strength in all the markets. A buying movement started in Consols, spread to Home Railway Stocks, and made its influence felt in practically every department of the House. No particular reason developed for this change, but this did not make it in the least welcome, and the disappointing feature was the difficulty to get stock with which to supply the suddenly persistent buyers.

The Home Railway market has assumed a much brighter complexion as a consequence of quite a small demand for the leading issues. Apparently, a few investors have noticed that Home Railways return tempting yields at the present time, tempting enough, that is to say, to discount some of the labour possibilities which may materialise after the war. Improvement had not spread to the Undergrounds up to the time of the House dispersing for the Christmas holidays, but that it will do so early in the New Year is tolerably certain, provided strength is maintained amongst the steam stocks.

Home electricity shares show no changes at all throughout the list, but there has been some inquiry for the manufacturing companies, and the only dulness in the group is shown by British Aluminium ordinary, which went back to 32s., at which price a return on the money comes to just over 6¼ per cent. The Iron and Steel divisions have started to rally, and an appreciable recovery set in amongst rubber shares, assisted by a rise in the price of the material to half-a-crown per lb.

Mexican Light & Power common shares have been marked down to 5 points at 17½, and the severe slump in other Mexican issues, to which we made detailed reference last week, has not been counteracted by any recovery, notwithstanding the fact that Mexican stocks and shares as a whole are a slightly better market, or, as it might be more correct to say, a slightly less weak one. British Columbia 4½ per cent. Debenture has fallen 2 points, and Brazil Tractions weakened to 45½. The Anglo-Argentine Tramways stocks are dull on the announcement that the directors have decided to postpone the payment of a dividend on the First Preference, and the price of these shares has again fallen an eighth to 2⅜.

Globe Ordinary are better in the telegraph department, where other stocks maintain their prices well, although Great Northerns lost the £1 which they put on last week, the price reacting to 36. Marconis have come into demand again, due principally to the declaration of an interim dividend of 5 per cent. on Marconi Marines. This had the effect of strengthening the price of the last named to 52s., while Americans rose to 24s., and Canadians to 11s. The telephone market throughout is firm.

Having regard to the shortage of time and paper, the brevity of the market report may possibly be excused this week. Which same brevity makes no difference to the cordiality of the wish, to those who have the patience to read these notes, that they may enjoy a Peaceful and Prosperous New Year.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Dec. 31, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	5⅝	—	6 13 4
Chelsea	4	3	2⅞	—	5 9 1
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅝	—	5 18 6
County of London	7	7	11	—	6 7 8
do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	7	6	9⅝	—	5 11 7
London Electric	3	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	3	3	3⅝	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	6⅜	—	6 13 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	8	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅞	—	5 9 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96	—	6 5 0
do. Def.	33/8	1½	22⅜	—	6 8 4
Chile Telephone	8	8	7 7/16	—	5 11 4
Cuba Sub. Ord.	5	7	9½	—	*7 11 4
Eastern Extension	8	8	15	—	*5 6 8
Eastern Tel. Ord.	8	8	150½	—	*5 6 4
Globe Tel. and T. Ord.	7	7	13⅞	+ ⅛	*5 1 10
do. Pref. ..	6	6	101 xd	—	5 17 1
Great Northern Tel.	22	24	36	— 1	6 11 6
Indo-European	13	13	62½	—	6 9 10
Marconi	10	15	3 1/16	—	4 17 10
Oriental Telephone Ord. ..	10	10	3	—	3 6 8
United R. Plate Tel.	8	8	6 13/16	—	*5 17 6
West India and Pan.	6d.	6d.	1 1/16	—	*3 9 6
Western Telegraph	7	8	15½	—	*5 5 —
Home Rails.					
Central London, Ord. Assented	4	4	60¼	—	6 12 —
Metropolitan	1	1	21⅛	—	4 11 0
do. District	Nil	Nil	18¼	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	81	—	*4 18 9
Foreign Trams, &c.	Dividend 1915.	Dividend 1916			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅜	— ⅛	—
do. 2nd Pref. ..	5½	—	2⅜	—	—
do. 5 Deb. ..	5	5	66½	—	7 10 8
Brazil Tractions	4	4	45½	—	—
Bombay Electric Pref.	6	6	9⅜	—	6 4 9
British Columbia Elec. Ry. Pfce.	5	5	4½	—	11 15 4
do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	56	— 2	7 11 9
Mexico Trams 5 per cent. Bonds	Nil	Nil	32½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	3⅜	—	Nil
Mexican Light Common ..	Nil	Nil	17½	— 5	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	32½	—	—
Manufacturing Companies					
Babcock & Wilcox	15	15	3.5	—	4 14 1
British Aluminium Ord. ..	7	10	1 15/32	— ⅛	6 5 9
British Insulated Ord.	17½	20	3	—	6 13 4
British Westinghouse Pref. ..	7½	7½	2 1/16	—	5 11 4
Callenders	20	20	14½	—	6 18 0
do. 5 Pref.	5	5	4⅜	—	6 1 8
Castner-Kellner	22	20	8 3/32 xd	—	3 17 8
Edison Swan, fully paid ..	—	—	2⅜	—	NB
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅜	—	6 13 4
Gen. Elec. Pref.	6	6	10½	—	5 14 3
do. Ord.	10	10	19⅝	—	5 1 3
Henley	25	25	16⅜	—	7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14⅜	—	*6 16 7
Telegraph Con.	20	20	41½	—	*5 15 7

* Dividends paid free of income-tax.

ELECTRICAL COOKING AS APPLIED TO LARGE KITCHENS.

By W. A. GILLOTT, A.M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

(Concluded from page 600.)

The following schedules contain particulars of some of the installations equipped in Newcastle, and give sufficient evi-

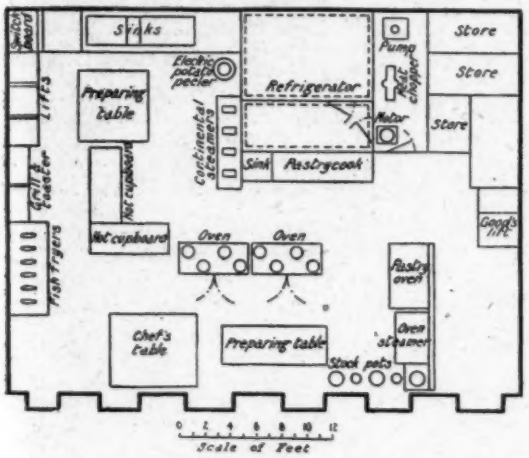

Fig. 5.—Plan of Electrical Apparatus in Main Kitchen at Installation "A."

dence that satisfactory results are being achieved on this class of work.

Every establishment has its own special conditions, and each has to be dealt with accordingly; for instance, at installation "A," the menu is of a very varied nature, but at installations "B" and "C" the menu is only slightly varied to suit the different classes of persons catered for. If we take the case of a workhouse or an asylum, where large quantities of one class of food are required, larger pieces of apparatus would be installed, and owing to the less variety in the menu, a smaller number of pieces of apparatus would be supplied.

Installation "A" (see Figs. 1, 2, 5, and 7 to 9): Connected September, 1916. Class—Restaurant.

Main Kitchen.

Baker's Oven: One piece; two decks, heated by crown and sole elements, split into 12 sections, 3-heat control on each section. 15 kw.
Double Oven Range: Two ovens under one hot-plate, 3-heat control. Hob-plate fitted with two 10-in. and two 8-in. boiling rings, each with 3-heat control. 17.5 kw.
Double Oven Range: Ditto. 17.5 kw.
Hot Cupboards: Two, with 3-heat control. 12 kw.
Fish Range: Six oval fryers, 3 kw., with 3-heat regulation, 18 kw.
Continental Type Steamers: One range of four pans, 3 kw. each, with 3-heat regulation. 12 kw.
Grills and Toasters: Two combination grills and toasters fitted in tiers, each 4 kw. 16 kw.
Egg Poacher: One poacher with six insets to take 12 eggs. 2.2 kw., 3-heat regulation. 2.2 kw.
Egg Poacher: Ditto, for six eggs, 1.5 kw. 1.5 kw.

Café Servery.

Hot Cupboard: One loaded to 3 kw. with 3-heat regulation. Top fitted with four 8-in. hot-plates, each 1.1 kw., with 3-heat regulation. 7.4 kw.
Grill and Toaster: One, as in main kitchen. 8 kw.
Water Urns: Two 10-gallon urns, each 6 kw. with 7-heat regulation, fed with water at 150 deg. F. 12 kw.
Café-au-lait: One 3-jar suite, each jar of five pints capacity, 3 kw. with 3-heat regulation. 3 kw.
Egg Poachers: As in main kitchen. 3.7 kw.

Smoke-room Servery.

Hot Cupboard: One fitted with two Continental type steamers (as in main kitchen), two 8-in. hot-plates and warmed top. Cupboard loaded to 3 kw.; top to 1.5 kw.; steamers to 2 kw. each, and hot-plates to 1.1 kw. each, all with 3-heat regulation. 10.7 kw.
Hot Cupboard: One fitted with three carving wells and overhead gear, and one Bain Marie. Cupboard loaded to 3 kw., carving wells 2 kw., and Bain Marie 1.5 kw., all with 3-heat regulation. 6.5 kw.
Grill and Toaster: Two, as in main kitchen. 16 kw.
Water Urn: Two, as in café servery. 12 kw.
Café-au-lait: One as in café servery. 3 kw.
Warming Cabinet: One in two tiers, arranged with top heat for keeping savouries hot. Each unit loaded to 1.5 kw., 3-heat regulation. 3 kw.
Fish Fryers: Two, similar to main kitchen, loaded to 2 kw. with 3-heat regulation. 4 kw.
Egg Poachers: Poachers for 12 and six eggs. 3.7 kw

Dining-room Servery.

Hot Cupboard: One as in smoke room. 10.7 kw.
Hot Cupboard: One with carving wells, as in smoke room. 6.5 kw.
Toaster: One fitted with hot cupboard oven; heat unit split in half and arranged for 2-heat regulation. 4 kw.
Water Urns: Two as in smoke room. 12 kw.
Café-au-lait: Ditto. 3 kw.
Egg Poachers: Poachers for 12 and six eggs. 3.7 kw.
Warming Cabinet: One as in smoke room. 3 kw.
Total loading of whole equipment, 247.6 kw.

Installation "B": Connected August, 1915. Class—Staff Feeding.

Kitchen.

Roasting Oven: One cabinet-type, loaded to 15 kw. with two sets of elements on each side and back, with 6-heat regulation. 15 kw.
Oven Range: One treble oven range with two ovens loaded to 5 kw. with 3-heat regulation, and one pastry oven of 2-deck type, loaded to 4 kw. Range fitted with two 12-in., two 10-in., two 8-in., and one 6-in. hot-plates, all with 3-heat regulation. 24.9 kw.
Vegetable Steamer: One double steaming oven, each oven containing five galvanised iron trays, each capable of holding 28 lb. of potatoes (or equivalent), water-fed automatically by ball-valve cistern. Each oven 5 kw., 3-heat regulation. 10 kw.
Water and Coffee Urns: Three 10-gallon water urns, each 5 kw., 9-heat regulation. One 10-gallon coffee urn. 18 kw.
Stock Pots and Soup Boiler: Four 10-gallon pans, each 3 kw., 3-heat regulation. 12 kw.
Fish Range: Four fish fryers, two 3 kw. each, two 2 kw. each, 3-heat regulation. Fixed on planished table. 10 kw.
Grills: One 2-tier grill, each 5 kw., 2-heat regulation. 10 kw.
Hot Cupboard: One, with three carving wells. Cupboard 3.5 kw., and top 2.5 kw., 3-heat regulation. 6 kw.
Water Urn: One quick-boiling urn of 1-gallon capacity, 3-heat regulation. 2 kw.
Egg Poachers: Two with three insets, each with a capacity of two eggs. 3 kw.

Servery 1.

Hot Cupboard: One fitted with two carving wells, cupboard 2.5 kw., top 1.5 kw., 3-heat regulation. 4 kw.

Servery 2.

Hot Cupboard: Ditto 4 kw.

Servery 3.

Hot Cupboard: One with three carving wells and two sauce pots, cupboard 3.5 kw., top 2.5 kw., 3-heat regulation. 6 kw.

Servery 4.

Hot Cupboard: Ditto. 6 kw.
Total loading of kitchen equipment, 130.9 kw.

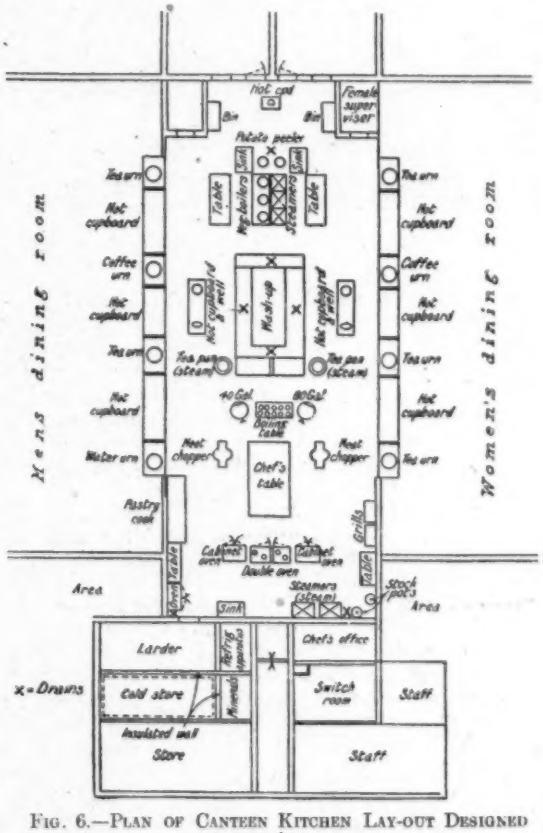

Fig. 6.—Plan of Canteen Kitchen Lay-out Designed by the Author.

The following are installed in the same building, but in no way run in conjunction with the larger kitchen:—

Double Oven: One double oven range, each oven 3 kw. Over ovens hob-plate containing three 8-in. and one 6-in. hot-plate, and one grill, all (except grill) with 3-heat regulation. 13.2 kw.
Water Urn: One 4-gallon urn, 3 kw., 3-heat regulation. 3 kw.
Special Warming Suite: One hot cupboard with one 15-gallon urn, one grill, and two 8-in. hot-plates; cupboard 4 kw., urn 8 kw., grill 4 kw., and hot-plates 1.1 kw. each. All (except grill) with 3-heat regulation. 18.2 kw.
Total loading of large and small kitchen equipments, 165.3 kw.

Installation "C": Connected June, 1914. Class—Staff Feeding.

One double oven range, 23 kw. One 4-gallon boiling pan, 3 kw. One 4-gallon water urn, 3 kw. One grill, 4 kw. One hot cupboard, 3.5 kw. One carving table, 4 kw.
Total loading of whole outfit, 40.5 kw.

Installation "D": Connected March, 1915. Class—Staff Feeding.

One double oven range, 13.3 kw. One 12-gallon boiling pan, 6 kw. One pudding steamer, 2 kw. One grill, 4 kw. One oval fish fryer, 2 kw. One 4-gallon urn, 3 kw. One hot cupboard, 2.5 kw.
Total loading of whole equipment, 32.8 kw.

The following table shows the details of consumption, cost of maintenance, &c., on the installations referred to:—

Installation.	Period of observation.	Consumption in units.	Average number of meals per week.				Cost of maintenance per 1,000 units consumed.	kw. connected.	Remarks.
			Breakfasts.	Luncheons.	Teas.	Total.			
"A"	10 months	122,052	389	5,186	3,943	9,518	1s. 6½d.	247·6	See below.
"B"	1 year	97,140	204	1,480	1,360	2,044	2s. 9d.	180·9	
"C"	1 year	21,141	211	454	328	991	2s. 9½d.	40·5	
"D"	1 year	20,690	48	371	221	640	4s. 6½d.	32·8	

Remarks.—"A." In addition to the figures of meals, there is a weekly average of 600 Bovrils and hot drinks. The list of the quantity of food cooked is a weekly average. From tests taken, the consumption of energy per person served, including staff, is 0.29 unit per meal.

Fig. 7.—Dining Room Servery, Installation "A."

"B." The list of the quantity of food cooked and consumed on an average day gives a good indication of the nature of the work performed. There are, however, several items carried out by the apparatus which do not come under the heading of cooking for the staff. The estimated consumption of electricity per person is 0.5 unit per meal.

"C." No list of food cooked has been obtained from this installation, but the consumption of electricity per person per meal is 0.41 unit.

"D." In addition to the number of meals provided, there is a weekly average of 16 Bovrils and hot milks, and 50 lb. of bread baked and nine suppers. There are also occasions when large quantities of food are cooked and consumed at other places, a list of which is given. The consumption of electricity per person catered for is 0.51 unit. The cost of maintenance on this installation is high because during the last 18 months the apparatus has been catering for 100 per cent. more people than originally intended.

In conjunction with these figures, one must also consider the advantages of electrical cooking from the economy of labour and food, simplicity of operation, the less fire risk, the saving on utensils, cleanliness, and the less floor space required as compared with coal, gas, or steam.

The details of operation of the supplementary plant at installation "B" are not included in this analysis, or in the chart showing the nature of the load, as they are used mostly for warming up food.

In the analysis, all elements, &c., that have been supplied free under guarantee have been included at their ordinary costs; workmen's train fares have been omitted in order to make a true comparison with those installations close to the workshop.

Maintenance Analysis of Installations "A," "B," "C," and "D."

Installation.	Oven.	Elements.					Vegetable steamer.	Wiring faults.	Earthing faults, terminals, &c.
		Hot-plate.	Grill.	Urn.	Hot cupboard.	Fish fryer.			
"A" ...	4	2	7	—	—	—	—	17	4
"B" ...	20	16	25	5	2	3	7	27	25
"C" ...	—	22	1	1	—	—	—	14	3
"D" ...	2	28	28	—	—	—	—	17	2

Average quantity of food cooked and consumed at installation "A" *per week*:—

1,362 lb. of roast meat, 140 birds (average weight 3 lb. each), 282 grills, 300 lb. of sausages, 35 gals. of soup, 2,162 portions of fish, 140 lb. of Yorkshire pudding, 2,940 lb. of potatoes, 10½ pecks of peas, 63 cabbages, 84 lb. of turnips, 56 lb. of carrots, 56 lb. of milk pudding (in dry state), 854 portions of ham and eggs on toast, 1,150 cups of coffee, 215 gals. of water boiled from 150 deg. F., 1,265 portions of hot sweets, 112 lb. of scones, 42 lb. of pastry.

Average quantity of food cooked and consumed at installation "B" *per day*:—

73½ lb. of roast beef, 34 lb. of haricot mutton, 10 gals. of potato soup, 21 lb. of peas boiled, 10 lb. of beans boiled, 112 lb. of potatoes, 1 gal. of vegetable stock, 6 gals. milk pudding, 1 gal. of hot milk, 2 hams boiled (28 lb.), 80 eggs fried and poached, 1 side of bacon (grilled and fried), 100 gals. of water boiled from cold, 22 lb. of chops grilled, 67 slices of toast, 10 gals. of coffee, 2 lb. of Quaker oats.

Average *monthly* list of food prepared on the apparatus at installation "D" and consumed at other places:—

218 lb. of boiled beef, 98 lb. of roast beef, 77 lb. of boiled ham, 230 lb. of bread, 50 gals. of water boiled from cold, 50 teas, 21 lb. of beetroot, 16 lb. of cake.

A comparison of the initial costs of installations "A" and "B" with electrical apparatus, gas apparatus, and a mixture of coal, gas, and steam apparatus, is given in the following table (the cost of connecting up the apparatus to the source of supply is in each case included):—

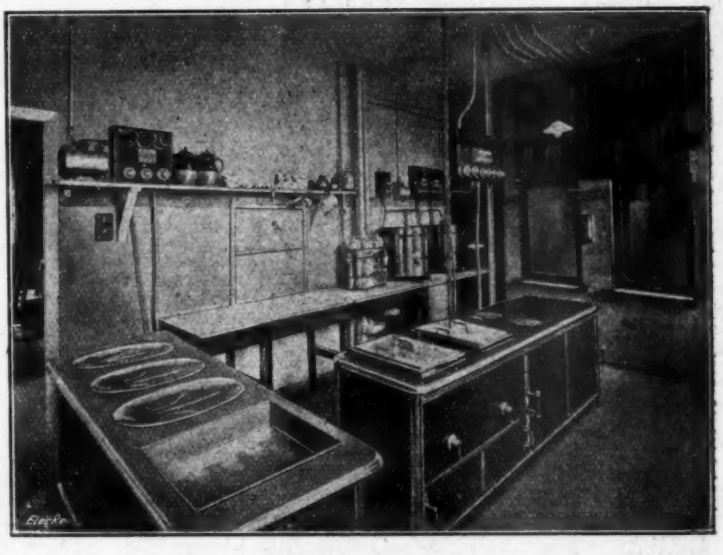

Fig. 8.—Smoke Room Servery, Installation "A."

Installation.	Electricity.	Gas.	Coal, gas and steam.
	£ s. d.	£ s. d.	£ s. d.
"A"	1,446 19 0	1,169 0 0	1,275 0 0
"B"	566 6 0	488 0 0	536 0 0
"C"	108 12 0	98 10 0	—
"D"	111 12 6	104 8 0	—

In the case of gas apparatus, the warming cabinets and portable fish fryers in installation "A" have been omitted.

as it was impossible to obtain prices for them. It is doubtful, however, if they could be supplied for gas heating. In the case of the coal, gas, and steam apparatus at the same installation, oven roasting, pastry baking, and grilling would be carried out by coal or coke (with the exception of the grills in the serveries, which would be done by gas); the hot cupboards and steamers by steam, and the remainder of the apparatus would be heated by gas.

On installation "B," under coal, gas, and steam apparatus, coal or coke would be used for the treble oven range and grilling, gas for the cabinet roaster and fish fryers, and the

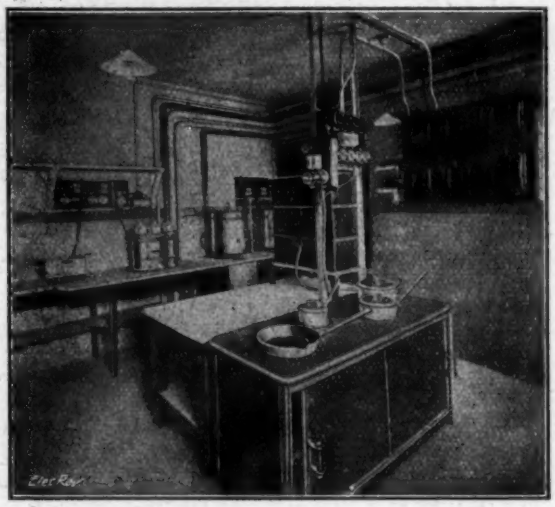

Fig. 9.—Cafe Servery, Installation "A."

remainder of the apparatus would be heated by steam.

The author is indebted to the Falkirk Iron Co., Ltd., for supplying the prices of the apparatus for coal, gas, and steam.

The difference in the initial cost is not so much with an installation of coal, gas, and steam, as with gas alone, but it would be impossible to use gas apparatus only on installation "A," for instance, owing to the restricted space. The first cost is not the only cost to be considered, and should never be looked upon as the predominant factor.

When the working comparisons are considered, electricity has the advantage in almost every detail, the following being a few of the essential items which in the majority of cases when carefully gone into offer sufficient advantages to outweigh any difference in capital cost:—

1. Cleanliness and absence of fumes.
2. Constant heating value, also the facility of reducing the heat to a definite degree, which is impossible with either coal, gas, or steam.
3. Reduced labour costs as compared with coal or steam.
4. Less floor space required, owing to the fact that electrical apparatus can be installed in almost any position, and in some cases mounted on tables or one above the other. Less floor space means less rent.
5. Economy in food, owing to less shrinkage of meat and less waste of food.
6. Saving on the renewal of kitchen utensils.

There are many other incidental advantages, but the above are in themselves sufficient to justify the installation of electrical apparatus.

Fig. 6 shows the lay-out of a canteen kitchen designed and in course of construction by the author. It will be observed that arrangements have been made to carry out efficiently the preparation of food for cooking by the use of auxiliary plant—meat and vegetable choppers, potato peelers, &c. The kitchen is situated between the dining rooms, the plant being designed to supply the cooked food for 1,500 persons at one sitting. Special attention has been given to ensure quick service, and the washing-up arrangements are such that plates, &c., are cleaned with a minimum of handling. The total load connected is approximately 350 kw.

The charts reproduced in fig. 10 show the nature of the loads on the respective installations, the lower chart being a summation of the other four.

These charts of supply should be of special interest to central-station engineers, as they indicate how similar installations will affect the load on their stations and networks. They also form a guide as to what one may expect in the future when the majority of large kitchens are run by electricity. In the author's opinion this is only a question of time.

It is, of course, assumed that the central-station engineer, or the sales engineer, has a thorough knowledge of cooking apparatus and their performances before he starts his campaign; if not, either the services of an expert must be secured, or any attempt to increase the cooking load must be postponed until he has mastered the subject. The best way of buying his experience—and it can only be bought—is to erect a trial installation where he can closely watch its behaviour; by so doing he is getting his information first hand, from which he can lay his plans for future developments. If those engineers who have not yet attempted the large cooking business will look around their districts, they will be surprised to see the enormous amount of revenue that awaits them from large staff-feeding establishments, cafés, restaurants, &c., which will fully justify the first trial installation.

Discussion at Leeds.

The paper was discussed by the Yorkshire Local Section on December 18th. Mr. Gillott reiterated his remarks in London as to the necessity of co-operation between the central-station authorities and manufacturers, and the formation of an advisory committee, subsidised by both parties, to prepare campaigns, conduct demonstrations, and draw up schemes for submission to clients under expert guidance.

Mr. J. Shepherd, opening the discussion, said that, speaking merely as an engineer, and one who did not know much about kitchens, he thought that, whilst electricity was eminently suitable for cooking operations in small kitchens, some of the applications which had been illustrated as having been made in large kitchens were not so suitable for electrical operations as for steam. He did not think that the heating of very large hot-plates or cupboards, or the boiling of large quantities of water, or the making of large stews could be done as economically by electricity as by steam. Whilst this was not of consequence in the small kitchen, it was of considerable moment in the large kitchen.

Mr. T. Roles said the illustrations indicated that wonderful strides had been made in electrical cooking during the last few years. He agreed that it was very necessary that there should be co-operation between the supply companies and the manufacturers, and thought that the municipal engineer

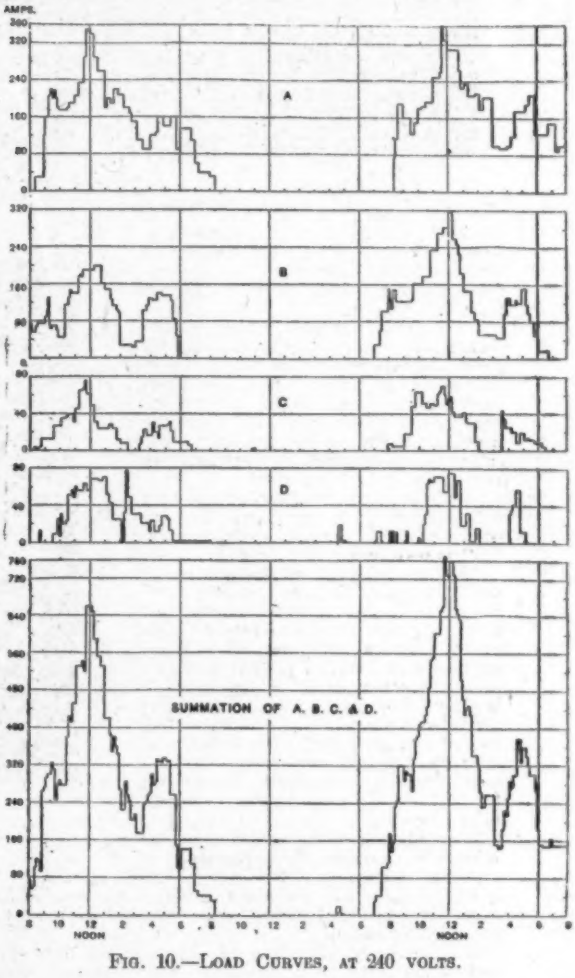

Fig. 10.—Load Curves, at 240 volts.

should also be included. An important difficulty to get over still was that of overcoming the objection that electrical apparatus cost so much more than the other apparatus for cooking purposes. He thought that the author was quite right in saying that the services should be run in duplicate, with a separate switch and fuse for each piece of apparatus. Domestic cooking had suffered very much in the past from the

fact that a whole range had only one fuse. He thought that the difference between an installation for a restaurant and that for a staff-feeding establishment, which the author had emphasised, was important, and that it was very necessary that the actual requirements should be ascertained very precisely before the installation was put down. It would be extremely interesting if they could get to know how the load curve of cooking affected the general load curve.

Mr. W. M. SELVEY said he thought this question of the cooking load might turn out to be one of the most important matters that the supply engineer had to consider. The important thing for the engineer was to know whether the cooking load would dovetail in with the rest of the load or whether it would be overlapping and merely intensifying the peak load.

Mr. C. E. ALLSOP spoke of the importance of a sufficiency of hot-cupboard space in the restaurant installation. He asked for the author's opinion on the thermometer in the use of ovens, the question of indicating lamps, the matter of pin-contacts, and the degree of pressure which was advisable.

Mr. H. W. WALKER said he thought that, in cooking installations, hardly enough attention had been paid to the matter of ventilation. He had failed to satisfy himself as to the amount of economy achieved by electrical cooking in regard to the shrinkage in meat.

Mr. W. B. WOODHOUSE said he had not the slightest doubt that, owing to the diversified apparatus now in operation, electric cooking was a sound commercial proposition, and compared very favourably with gas or steam. Steam heating might be very good if there was a steady use of it, but the load curves shown indicated that the cooking demand was very far from constant, and for the greater part of the day there would be a heavy loss in the steam. The tendency now, he thought, was for the lighting load in electricity supply to become relatively unimportant. There were cases in which the lighting load was less than 5 per cent. of the total.

Mr. GILLOTT, in reply, said he thought Mr. Woodhouse had answered the point in regard to steam. A good deal depended on whether or not steam was there already for another purpose. Undoubtedly the electrical was the cheaper form of apparatus for large kitchens in regard to maintenance costs. The running costs of gas were higher than those of electricity. An important matter in putting in an installation was to know with as much exactness as possible what it was required for. If in such matters engineers could not secure the services of an expert they should be guided by the chef. In regard to the relationship of the cooking-load curve to the general-load curve, they found in Newcastle that the cooking load came on just when it was wanted, and it served to fill the gaps. The cooking load was going to be a very big thing, and those engineers who did not look after it were going to lose money materially. Wiring troubles were getting much less than they used to be, but they were not yet down quite as low as he would like them to be. He did not approve of the use of thermometers, but got better results by teaching people how to use the apparatus. He mentioned an important case in which the instruction of a lady demonstrator had the effect of reducing the electricity consumption by 33 per cent. He thought that the best indicating lamp was an ordinary 8-c.p. lamp. Pin contacts he had discarded five years ago for reasons which he described. As to voltage, he thought the best results were got from a low voltage. In regard to ventilation, if there was too much of it the advantage of low shrinkage of meat food was liable to be lost. He had carried out tests showing as low a shrinkage in meat as 5 per cent., but he did not claim better than 15 or 20 per cent. in speaking to customers. In the most conclusive way, by tests of which he gave full details, it had been proved that the shrinkage in weight of meat was less in the case of electrical cooking than in that of any other process, and that the yield of fat—which was so valuable nowadays that in one notable case on record the yield of the sale of it more than paid the cost of the electricity used—was larger by the use of electricity in cooking than by any other process.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

18,281. "Liquid rheostats." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. December 10th. (U.S.A., December 9th, 1916.)
18,283. "Electric-current controllers." J. ANDERSON & G. ELLISON. December 10th.
18,295. "Signalling and train-stopping apparatus." E. H. WHITEHEAD. December 10th.
18,325. "Device for testing electric ignition of internal-combustion engines." F. W. MURRAY. December 11th.
18,339. "Telephone transmitters." A. MARR. December 11th.
18,343. "Miners' electric handlamps." A. H. RAILING & A. E. ANGOLD. December 11th.
18,349. "Electrical separation of suspended particles from gaseous bodies." H. A. BURNS. December 11th.
18,377. "Ignition devices for internal-combustion engines." F. L. HOLLISTER. December 11th.
18,378. "Spark-gap devices." F. L. HOLLISTER. December 11th.
18,379. "Ignition dynamo." F. L. HOLLISTER. December 11th.
18,407. "Electrically-operated apparatus for displaying advertisements, &c." J. A. BILBY, W. CLOSE & P. G. PALMER. December 12th.
18,413. "Electric transformers." SIEMENS SCHUCKERTWERKE. December 12th. (Germany, July 9th.)
18,418. "Electro-deposition." C. W. DENNY. December 12th.
18,427. "Electric welding." S. WHYTE. December 12th.
18,429. "Welding metals." S. WHYTE. December 12th.
18,438. "Multiple electric switches." V. E. JOYCE & PARK ROYAL ENGINEERING WORKS. December 12th.
18,441. "Electric dry cells." H. DE LA T. FENTUM PHILLIPS. December 12th.
18,442. "Electric transformers." BRITISH THOMSON-HOUSTON CO. & F. W. COOKE. December 12th.
18,449. "Machines for applying caps to electrode rods of batteries." S. L. CASELLA. (U.S.A., January 2nd.) December 12th.
18,453. "Electric cables." CALLENDER'S CABLE & CONSTRUCTION CO. AND W. WILLIAMS. December 12th.
18,476. "Fittings for incandescent electric lamps." F. QUARMBY. December 13th.
18,487. "Electric cables." PIRELLI & CO. December 13th. (Italy, March 26th.)
18,489. "Portable lamps for signalling taxi-cabs, &c." J. H. STRINGER. December 13th.
18,490. "Electric recording instruments." E. FAWSSETT. December 13th.
18,494/5/6. "Engine starters." V. BENEDIX. December 13th.
18,497. "Engine starters." F. B. DEHN (Eclipse Machine Co.). December 13th.
18,501. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. (U.S.A., December 15th, 1916.) December 13th.
18,502. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. (U.S.A., January 8th.) December 13th.
18,533. "Headgear for telephone, &c., receivers." H. W. METCALFE. December 13th.
18,536. "Methods of operating flaming arc lights for projectors." SPERRY GYROSCOPE CO. (U.S.A., December 18th, 1916.) December 13th.
18,542. "Spark plugs." H. J. BERRY. December 13th.
18,564. "Electric switches." ELECTRIC & ORDNANCE ACCESSORIES CO. AND J. ETCHELLS. December 14th.
18,567. "Electric switch plugs." R. CRUST. December 14th.
18,568. "Electric meters of the movable-coil type." R. BEATTIE. December 14th.
18,595. "Automatic and semi-automatic telephone systems." AUTOMATIC ELECTRIC CO., AUTOMATIC TELEPHONE MANUFACTURING CO. & F. C. TOMLINS. December 14th.
18,597. "X-ray tubes." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) December 14th.
18,600. "Mercury switches." G. W. STEPHENSON. December 14th.
18,603. "Projector arc lamps." J. BROCKIE AND JOHNSON & PHILLIPS. December 14th.
18,610. "Automatic electric switches for polyphase currents." H. F. JOEL. December 14th.
18,613. "Flashlamps." C. J. HARVEY & H. W. HOOPER. December 14th.
18,621. "Audion or lamp relay or amplifying apparatus." M. LATOUR. (France, November 30th, 1916.) December 14th.
18,627. "Magneto compasses for aerial navigation, &c." A. L. NEALE, A. V. PARIS & H. YEOMANS. December 14th.
18,641. "Means for locking incandescent electric lamps to holders." H. SMITH. December 15th.
18,649. "Electric pocket-lamp." E. G. PHOEBUS COMP. (Switzerland, March 7th.) December 15th.
18,657. "Electric arc striker." BRIAN, FORREST & CO., J. C. BRIAN AND T. A. FORREST. December 15th.
18,682. "Condensers." O. R. VERITY. December 15th.
18,683. "Electric cable grips." W. T. HENLEY'S TELEGRAPH WORKS CO., E. MOOR & W. H. NICHOLS. December 15th.
18,689. "Method of transforming anthracite coke, &c., rich in carbon into a product suitable for manufacture of carbon electrodes." S. E. SIEURIN. December 15th.
18,700. "Electric current rectifiers." H. S. MILLS & H. WADE. December 15th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

11,377. APPARATUS FOR AUTOMATICALLY CONTROLLING FROM A DISTANCE VARIABLE-SPEED OR REVERSIBLE ENGINES. L. J. Creplet. October 4th, 1915. (101,699.)
16,540. BRUSH-LIFTING AND SHORT-CIRCUITING DEVICES ON INDUCTION MOTORS AND THE LIKE. T. H. Hurst & Brush Electrical Engineering Co. November 18th, 1916. (111,324.)
16,566. APPARATUS FOR PRODUCING PERFORATED STRIP BY ELECTRICAL CURRENT IMPULSES. H. H. Harrison and Creed & Co. November 18th, 1916. (111,336.)
16,737. RADIO-TELEGRAPH AND TELEPHONE STATIONS. F. G. Simpson. November 22nd, 1916. (111,332.)
16,835. MINE SIGNALLING SYSTEMS. J. Davis & Son and W. H. Davis. November 24th, 1916. (111,339.)
16,897. MEANS AND APPARATUS FOR AUTOMATICALLY RENDERING DEFECTIVE TELEGRAPHIC SIGNALS UNIFORM, AND FOR STORING THEM UP PREPARATORY TO TRANSMISSION. November 24th, 1916. (111,343.)
16,907. CONNECTION OF ELECTRIC CABLES TO JUNCTION BOXES OR LIKE APPARATUS. British Insulated & Helsby Cables, Ltd., and R. W. Blades. November 25th, 1916. (111,344.)
16,992. "Electric motor controllers." E. C. R. Marks (Mercury Manufacturing Co., U.S.A.) November 27th 1916. (111,347.)
17,189. PROTECTION OF ELECTRIC SUPPLY OR DISTRIBUTION SYSTEMS IN WHICH SPLIT OR PARALLEL CONDUCTORS ARE EMPLOYED. Electric Improvements, Ltd., Callender's Cable & Construction Co., Ltd., and T. O. Callender. November 30th, 1916. (111,351.)
17,553. ELECTRICAL SWITCHES. R. W. Bill. December 7th, 1916. (111,361.)
17,912. WELDING OF PLATES. Quasi Arc Co. & W. L. Cole. December 13th, 1916. (111,363.)
18,541. ELECTRICAL HEATING APPARATUS FOR PERMANENTLY WAVING HAIR ON THE HEAD. E. F. Suter. December 28th, 1916. (111,372.)

1917.

180. MAGNETO-ELECTRIC MACHINES. M-L. Magneto Syndicate, G. A. Lister and E. A. Watson. January 4th, 1917. (111,373.)
788. CARBON HOLDERS OF ELECTRIC ARC LAMPS. W. L. Humphries. January 16th, 1917. (111,382.)
860. ELECTRIC BATTERIES. H. D. Henry. January 17th, 1917. (111,383.)
1,577. MAGNETO DEVICES FOR INTERNAL-COMBUSTION ENGINES. Villiers Engineering Co., G. Funck & F. H. Farrer. January 31st, 1917. (111,391.)
2,036. TROLLEY HEADS FOR ELECTRIC TRACTION. W. Pickersgill & J. H. Pitt. February 10th, 1917. (111,396.)
2,621. ELECTRICAL MASSAGE APPLIANCES. E. Peckham. July 4th, 1917. (111,399.)

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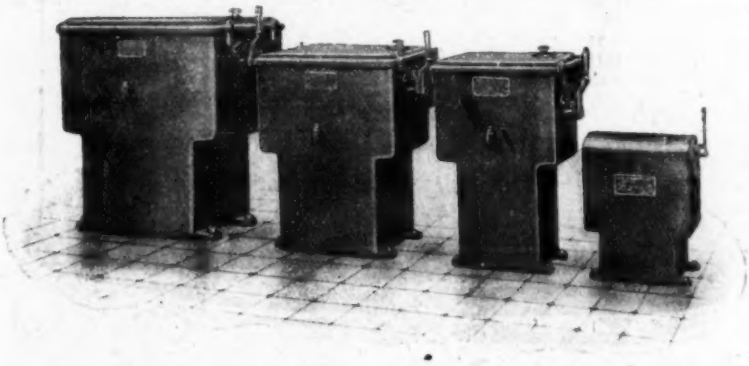

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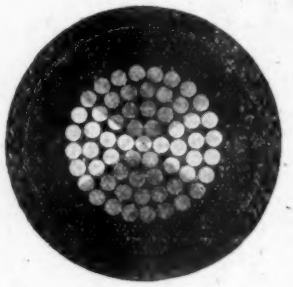

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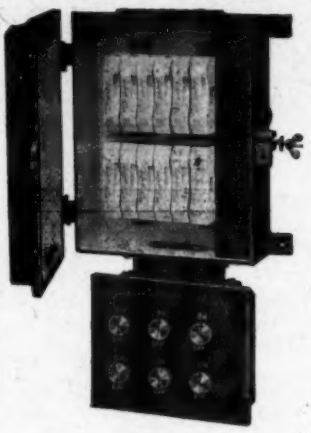
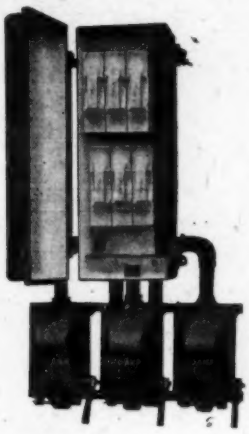
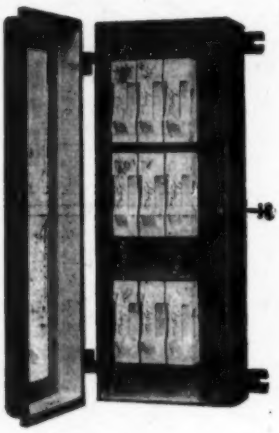

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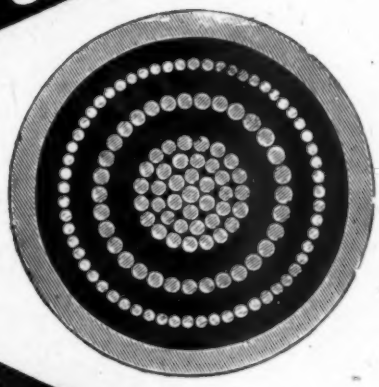

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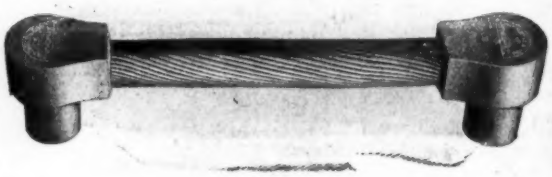

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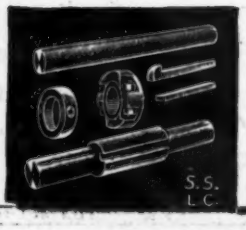

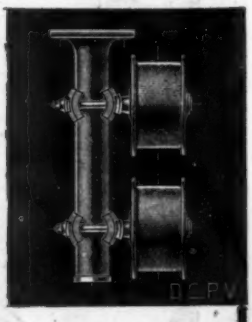

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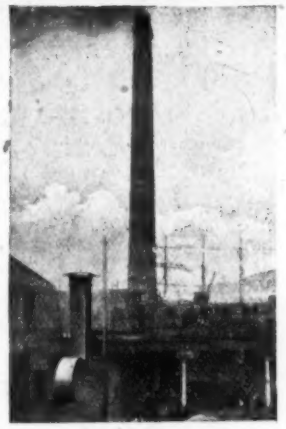

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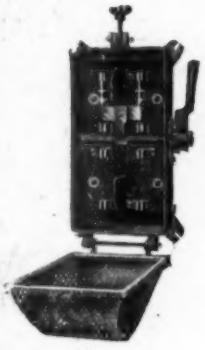

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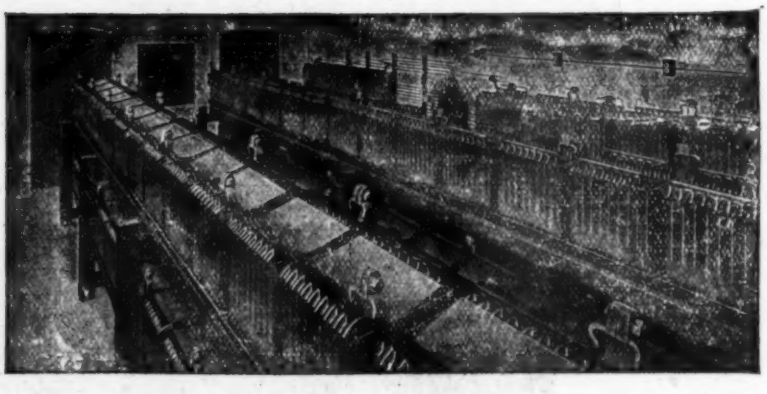

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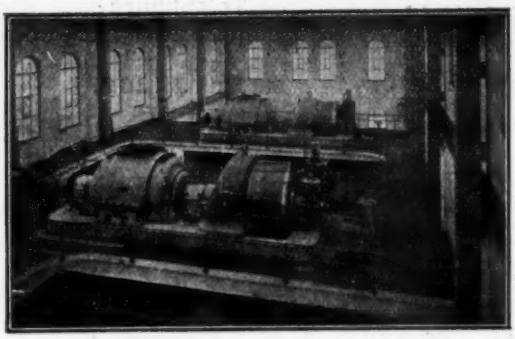

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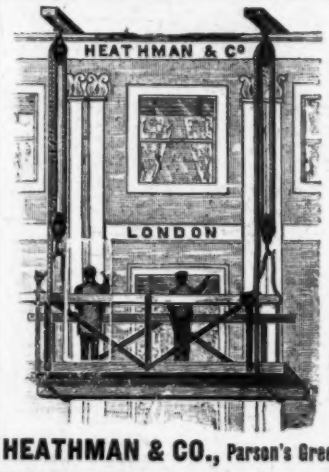

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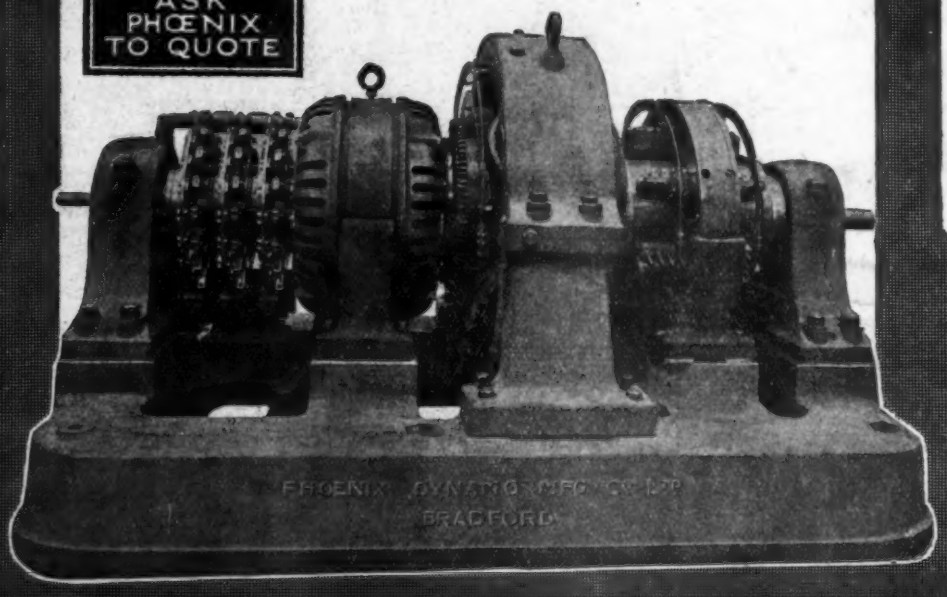

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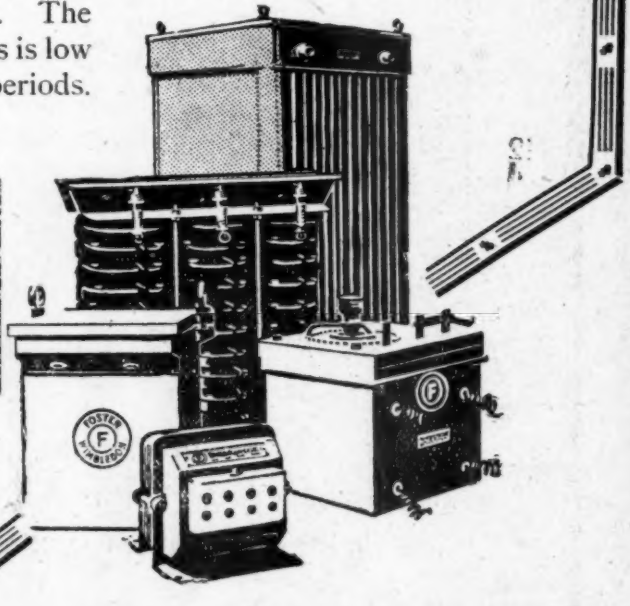

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The indications of this Synchroscope are infallible.

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The movement of the pointer is smooth and certain and inspires confidence.

The superior design and construction of the instrument ensures a very long life and permanent accuracy throughout its life.

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It is impossible to make an error in synchronising with it.

We invite the most Minute and Critical Examination of this Instrument, both Electrically and Mechanically, in comparison with any other Synchroscope at present Manufactured, and we are confident that a Comparative Test of the Instrument will easily demonstrate the Superiority of the Weston Synchroscope.

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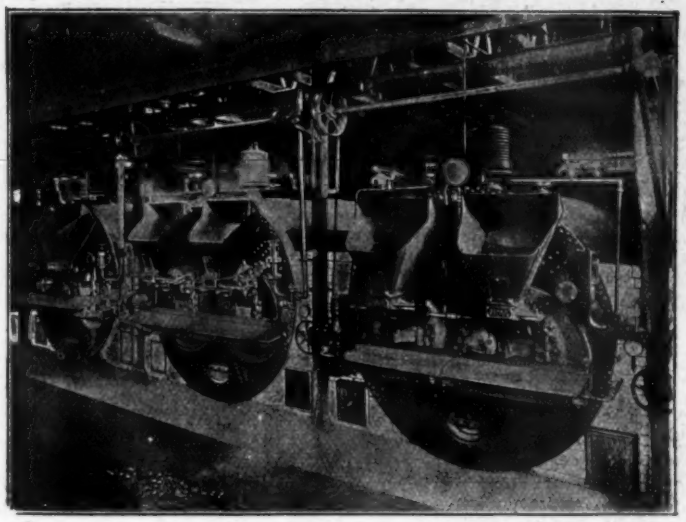

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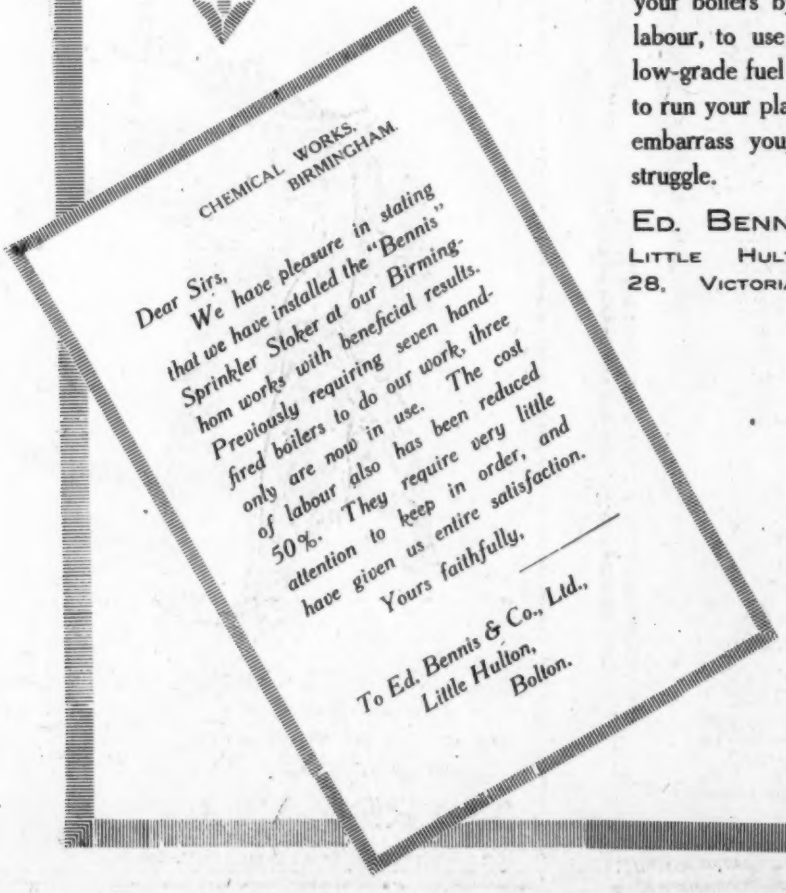

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The original of this letter is available for inspection by any *bona-fide* enquirer. It is one of many hundreds we have received from satisfied users of "BENNIS" Machines.

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COMBINED WATERTIGHT SWITCH AND 3-PIN PLUG,

Fitted with

SAFETY INTERLOCKING DEVICE.

(Shows Plug removed.)

The Plug is Gun Metal, fitted with Cord Grip to take Cab Tyre or our Tough Rubber-Jacketted Flexible Cord specially manufactured for use with this Plug.

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Interlocking Type. Non-watertight.

This interlocking 3-Pin Plug (2 Pins and Earth) is mounted on Iron base, screwed ¾ in. Electrical Conduit thread. As in the watertight type, the Plug cannot be inserted when the switch is on the "on" position, and can only be withdrawn when the switch is in the "off" position. The Plug is of wood and of the hand-shield type.

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Supplied Single or Double-Pole.

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TWO WAYS.

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NUMBER OF SINGLE POLE 5 AMP. SWITCHES.

1	2	3	4	5	6	7	8	9	10	11	12
4/8	9/4	14/-	18/8	23/4	28/-	32/8	37/4	42/-	46/8	51/4	56/-

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As supplied to the War Office, and important Government, Railway and Dock Contracts.

Made in 2 or 3-pin plug type from 10 to 500 amps. capacity.

These plugs are substantially well-made. They are fitted with stout earthing connection, which make connection first and break connection last. A protecting cap is fitted with a chain which prevents the current-carrying parts from exposure when plug is out.

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TUBOLITE does not project into the space required for goods, nor does it throw a glaring light in the direction of the street. The window display is shown to the best advantage in a clear well-diffused and attractive light. The specially-designed reflector increases the useful light by 50 to 100 per cent.
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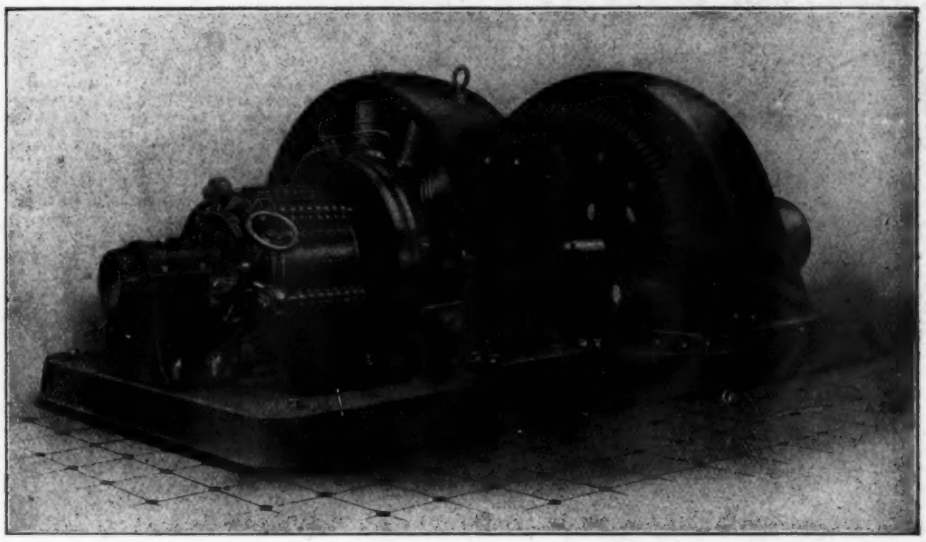
Electrical Plant of every description.



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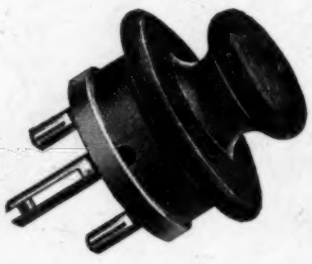
IT IS SELF CONTAINED. NO SEPARATE SWITCH IS REQUIRED. IT IS AUTOMATIC IN ACTION, THE RAPID MAKE AND BREAK SWITCH MECHANISM BEING OPERATED BY THE INSERTION OR WITHDRAWAL OF THE PLUG.



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Motor runs at 10,000 R.P.M., giving the emery wheel the right surface speed. The arm fits into the slide rest of any ordinary lathe, in the same manner as any turning tool. Specially useful for quick and accurate grinding of centres, dies, cutters, etc. Weight 5½ lbs.

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Ref. No. M. 2865.

The spindle being off-set greatly facilitates drilling in corners. All gears are accurately cut. Will drill up to $\frac{1}{16}$-in. steel. Maximum consumption on load, 250 watts. Supplied complete with chuck, key, flex, switch and B.C. Adaptor.

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Wound for all Currents and Voltages.

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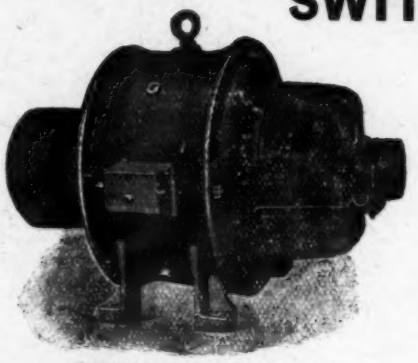

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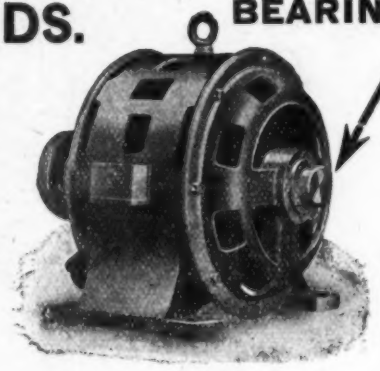

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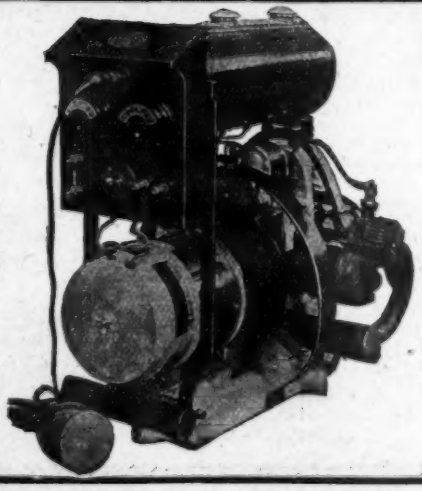

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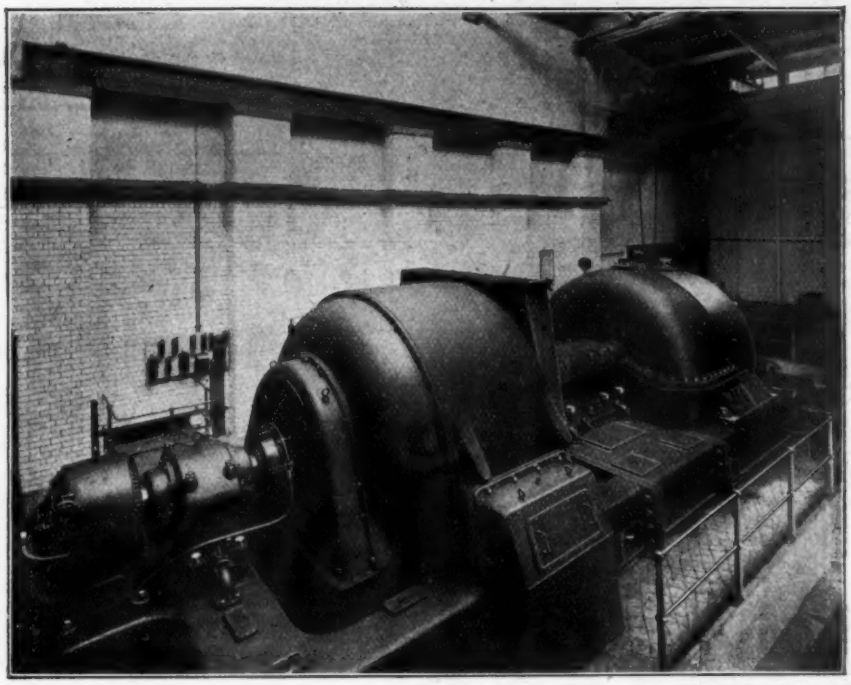
G.E.C. Electrical Plant



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D. E. WACHA,
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Chesham,
Bucks. 9276

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Further particulars and Forms of Application may be obtained from the Principal. These must be returned to the Institute before JANUARY 19th.

W. A. BROCKINGTON, M.A.,
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Applications, stating qualifications and teaching experience (if any), to be sent immediately to—

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Guildhall,
Westminster, S.W. 1. 9325

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South Irish District.

DISTRICT Electrical Engineer wanted, with practical experience of I.C. engine maintenance.

Must be ineligible for active military service.

For particulars of position, apply to :—

COMMANDING ROYAL ENGINEER,
South Irish District
Military Barracks, Mallow. 9312

THE LANCASHIRE ELECTRIC POWER CO.

THE above Company require a Shift Engineer : salary £17 per month. Permanency.

Applications to be sent to the undersigned as soon as possible.

M. H. ADAMS,
Resident Engineer.

Power Station,
Radcliffe, Manchester. 9319

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

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WANTED for period of war, possibly permanent appointment, Assistant for Distribution Department duties. Previous experience of A.C. mains system essential.
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BOROUGH ELECTRICAL ENGINEER,
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SHIFT Engineer wanted for low tension three-wire supply with batteries.—Applicants, who must be ineligible or of low category, to state salary required less any bonus that may be given. —Apply ELECTRICAL ENGINEER, Electricity Works, Bexhill. 9235

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CHARGE Engineer wanted in combined A.C. and D.C. Power Station.—Apply stating age, experience and wages required, enclosing not more than three testimonials, to the BURGH ELECTRICAL ENGINEER, Blackhall, Paisley. 9195

CENTRAL Station Fitter-Turner required for Generating Station in N.W. London. One with knowledge of turbine work given preference. District rates.—9258, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ELECTRICAL Wireman wanted. Class A and B work only. Must be first-class man.—State age and experience to H. ROGERS, Friars' Gate, Warrington. 9211

ELECTRICIAN wanted for plant maintenance; ineligible; good experience and refs.—Apply MANAGER, Power Station, Brimsdown, N. 3616

ENGINE Driver wanted immediately for tramways power station. Wages inclusive of war bonus 54s. 4d. per week of 56 hours. Applicants must be ineligible for military service. Permanent position for suitable man.—Apply stating age, experience, and enclosing copies of testimonials, to RHONDDA TRAMWAYS CO., LTD., Porth, Glam. 9255

ESTIMATOR for Electrical Control Gear wanted immediately in controlled establishment situated South Coast. Previous experience in similar capacity an advantage. No person already on Government work will be engaged.—Apply by letter, stating age, experience and salary required, to nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 9317.

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SITUATIONS VACANT.—*Continued.*

FITTERS and Turners wanted for power station; wages £3 5s., including bonuses.—Apply, stating age and experience, to 9284, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

HANDY Man wanted for Car Repair Works; must have had previous tramway experience.—State age, experience and wages required, and enclose copies of testimonials, RHONDDA TRAMWAYS, Porth, Glam. 3664

MACHINE Shop Foreman wanted for controlled establishment in London district (lathes, capstans, millers, drills and presses); experience in producing good results with junior labour on piecework preferred. No person on Government work, or living more than 10 miles away, engaged.—State experience fully, and wages asked, to 3562, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MAINS Assistant wanted, commencing salary £130 and £31 4s. war bonus. State age, experience, &c., to 9326, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

METER Superintendent, permanent staff appointment, Corporation, Midlands; £170, including war bonus.—Applications, giving full particulars of qualifications, 9327, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

POWER Station Superintendent. A large Chemical Manufacturing Company require an Engineer experienced in large power station work to superintend the construction and operation of their power plant. Applicants must have had a thorough training in this class of work and have had experience with Marine Type Boilers and Turbine Units over 6000-KW. capacity. Salary £400 per annum to commence. Only first-class men need apply, with copies of testimonials covering experience during past six years, and stating when they can take up duties.—9315, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFTMAN, wanted immediately; experience internal combustion engines, preferably Diesels, and alternators, about 35s. —Apply ELECTRICITY WORKS, Sundridge, Sevenoaks. 3639

STOREKEEPER, wanted for electrical contractors' business, experienced and trustworthy man required. No person already on Government work, or living more than 10 miles away, will be engaged.—Apply stating age, experience and salary required, to MESSRS. BELSHAW & CO., 2, Army & Navy Mansions, Victoria Street, S.W. 1. 9321

SALESMAN for electric fan and small motor department. Initiative and ability in handling correspondence essential. No one at present employed on Government work, or living more than 10 miles away, will be engaged.—3657, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant, wanted in a combined A.C. and D.C. power station.—Apply stating age, experience and wages required, enclosing not more than three testimonials to the BURGH ENGINEER, Blackhall, Paisley. 9241

TELEPHONE Exchange Wireman and Tester wanted on Government work. Permanency for good circuit man. No person already employed on Government work need apply. Give full details of past experience, wages required, &c.—Apply nearest EMPLOYMENT EXCHANGE, quoting A 4271. 9331

WANTED, Armature Winder for a tramways undertaking in Lancashire. State wages and type or armature conversant with.—9330, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, at once, Assistant Engineer, to take entire charge of car sheds and overhead equipment of tramways. A knowledge of permanent way repairs an advantage.—Reply, stating age, experience, wages required and when free, to the MANAGER, Sunderland District Electric Tramways, Fence Houses. 9324

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Draughtsman with transformer experience. Nobody engaged on Government work will be accepted.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A 4086. 9036

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

WANTED, experienced Electrician, ineligible.—Apply, stating age, wages and references, to ABERTHAW & BRISTOL CHANNEL PORTLAND CEMENT CO., LTD., Aberthaw, Glamorgan. 9318

WANTED, experienced Engineer-Electrician (ineligible) to take charge of lighting plant (Crossley gas engines and accumulators) London.—Apply by letter, stating experience and salary required, to "ELECTRICIAN," c/o Pool's, 180, Fleet Street, E.C. 4. 9320

WANTED for a Colliery in Kent, a Working Electrician, accustomed to high-tension three-phase work.—3592, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, on a Scottish power company (certified undertaking), a Shift Engineer, with good mechanical and electrical three-phase E.H.T. training. Good wages to a good man.—Apply, giving all particulars, with copies of references, to 9294, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, several Wiremen used to lighting and motors. No person already engaged on Government work need apply.—Apply by letter, giving experience, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A4232. 9210

SITUATIONS WANTED.

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CABLE Jointer; all-round experience.—"JOINTER," c/o A. LEACH, Wick Road, Hampton Wick, Middlesex. 3587

ELECTRICAL Engineer, disengaged shortly, practical, drawing office, design, and commercial experience, desires responsible position, would consider small partnership, Government work essential.—3582, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, young, College graduate, 4 years' subsequent practical experience with leading firms on design, drawing office and management 2,000-KW. works plant, desires responsible permanent appointment as Works Engineer or similar position. Government work essential. Free early in January.—3665, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN requires situation, good experience.—BROWNING, c/o 38, Mayfield Road, Enfield Highway, London, N. 3583

ENGINEER, Electrical and Mechanical (over military age), desires responsible position, practical and commercial experience, good address, buying, estimating, supervising; all branches.—3563, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, experienced mechanic (46), electrical and mechanical, seeks change, country only; charge plant estate or pumping station, steam, gas, Diesel engines; capable all repairs, alterations, improvements; now charge large private plant; wages £2 15s. week.—3615, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MECHANICAL and Electrical Engineer, with wide all-round experience, good organiser and used to control of male and female labour, shortly disengaged. Highest references.—3663, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

YOUNG Man, well educated, and capable of taking charge of office, desires post with a firm of manufacturing electrical engineers, to commence duties in the new year.—3621, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

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RUSSIAN Engineer, university trained, commercial and technical experiences, wide connections, desires to represent in Russia a first-class British firm. Highest references.—3647, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ADVERTISERS, with £1000 capital and wide practical experience, wish working control in small engineering firm near London.—3638, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (25), experienced in all branches, with small capital, desires partnership or active directorship. Just over military age. Remuneration to commence £300 per annum. Liverpool preferred.—3561, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

FOR SALE.

POWERFUL self-act Boring and Facing Machine, by J. Butler & Co., 7-in bar, 15-ft. long, approx., weight 30 tons.
Duplex Hori. Boring Machine, by J. Butler & Co., two upright standards 7 ft. high, carrying boring saddle, with 3½-in. diam. spindles.
12-in. centres Capstan Lathe on 5-ft. bed, by Bradbury and Co., Oldham.
11-in. centres double-geared Capstan Lathe, on 6-ft. bed, by W. H. Ward & Co.
7½-in. centres Capstan Lathe on 6-ft. bed, by Holroyd & Co., Milnrow.
7-in. centres Capstan Lathe, on 3-ft. 9-in. bed, by Holroyd and Co., Milnrow.
Parting-off machine, by Carter & Wright, take bars up to 5-in. diam.
Radial Drilling Machine, with 2½-in. spindle, self-act feed, 4-ft. 6-in. radius.
Six-spindle Drilling Machine, by Butler & Co., 1½-in. spindles, independent action.
Duplex Screwing Machine, by Dron & Lawson, with dies up to 2½-in. diam., Whitworth thread.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS.
Free on Application. Inspection invited.

THOS. W. WARD, LTD., Tel.: "Forward, Sheffield." ALBION WORKS, SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,
and at Milburn House, Newcastle-on-Tyne.
Tel.: 44 Wakefield. 867 Newcastle. Telegrams: "Engineer, Wakefield."

FOR SALE.

PARSONS Steam Turbine and Alternator, 3,500 KW., 1,200 R.P.M., 200 lbs. to sq. in., alternator field-rotating type and exciter complete; 6,000-volt maximum load, 40 cycles, 3-phase.
Willans-Parsons Steam Turbine and Alternator, 1,200 KW., 1,200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air and circulating water pumps, &c.
350-KW. Alternator, by the B.T.H. Co., 550 volts, 3-phase, 50 cycles, with Barclay's cross-compound horizontal Engines, 26" and 40" cyls. × 4-ft. stroke.
One 220-KW. Electrical Set, comprising Triple-Expansion Vertical enclosed Engine, by Belliss & Morcom, Alternator by B.T.H. Co., with Korting's Ejector Condenser.
Two Electrically-driven Diamond Coal Cutters, undercut 4' 6", Motor 25 H.P., 500 volts. 5277

ELECTRIC DYNAMOS AND MOTORS.

MACHINES always available for Sale or hire.
ARMATURES and FIELD COILS
rewound or repaired without delay.
'Phone: 5773 Holborn. MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 8485

ELECTRIC MOTORS.

SALE or Hire. Second-hand Machines in Stock. ARMATURES and Coils repaired at shortest notice.
THE TITAN ELECTRICAL CO., 9/11, Eagle Street, W.C.
'Phone: Central 13,191. 6493

(Continued on next page.)

FOR SALE.—*Continued.*

Messrs. THE BRITISH ELECTRICAL SUPPLY STORES
Transfer Works,
WHITLEY BAY, Northumberland.
Telegrams: "Transfer," Whitley Bay.

ELECTRICAL PLANT FOR SALE.

FOUR 375-KW. Williams-Siemens Sets, either shunt or compound, 460/550 volts. Engines, three-crank, triple expansion, built for 180 lbs. steam pressure, installed between 1897 and 1899.
One Allans Steam Generating Engine, extended box bed for generator compound, 70 I.H.P., perfect condition, cheap quick sale.
One 2000-KW., Willans-Bruce Peebles, 6000-volt, 3-phase, 40-period Turbo-Generator, fitted with surface condenser.
Two 110-volt, 600-amp., 450 revs. Edison & Swan Generators, rope-driven, perfect condition.
One 11-H.P., 230-volt, 44-amp., 710 revs. Holmes Motor.
One 225-KW., 8-pole, Generator, 350 revs., 550 volts, shunt and compound. Guaranteed six months.
One 75-KW. Generator, 440 volts, 500 revs., multipolar. Guaranteed six months.
We also hold a very large stock of A.C. and D.C. machines which we can deliver from stock. 7120

ARC LAMP CARBONS FOR SALE.

LARGE Stocks for Immediate Delivery.
Send particulars of your requirements.
ASCOG, LIMITED,
57, Hope Street,
Glasgow. 3456

CABLE FOR SALE.

50 MILES 3/22s, 600-meg. non-association English Cable, £11 5s. per mile.
50 miles 3/20s, 600-meg. non-association English Cable, £15 5s. per mile. Strictly net spot cash.
9316, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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TRADE RATES ON APPLICATION.

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A.C. Motors in Stock, Sale or Hire.—Single-phase, ½ H.P., 200 v.; 1 H.P., 100 v.; 1 H.P., 200 v.; 2 H.P., 100 v.; 2 H.P., 100 v. Two-phase, 1·5 H.P., 240 v.; 4 H.P., 220 v.; 5·5 H.P., 240 v. Three-phase, 0·3 H.P., 110 v.; 3 H.P., 200 v.; 6 H.P., 200 v. All 50 periods.—E. P. ALLAM & Co., 107, Gray's Inn Road, W.C. 1. 9217

A.C. Motors, 5 H.P.; three 2 H.P., 400 v., 3-phase, 50 ~, 950 revs., new; 7½ H.P., 200 v., 1-phase, 1500 revs., 83 ~, slip-ring; 2 H.P. and 1 H.P., 200 v., 1-phase, 50 ~, new.—SUGDEN, Wakering Road, Barking. 3636

ARC Lamps. 150 Davy direct current enclosed Arc Lamps, 6 amps., 100 volts each; 19 Davy flame Arc Lamps, direct current, 10 amps., 50 volts each. These are still in use for lighting large drapery establishment, but are being replaced by half-watt lamps. — Apply, JOHN WALSH, LTD., High Street, Sheffield. 3602

CARBONS, gas and electric globes and glassware.—STANDARD GLASS Co., Fairbank Street, N. 3631

CROMPTON 2-pole Generator, 27 KW., 110 volts, 500 R.P.M., with spare armature.—MARTINS, 320, Witton Road, Birmingham. 3578

D.C. Motors in Stock, Sale or Hire.—100 v., ½ H.P., 5 H.P.; 200 v., 2 H.P., 7 H.P.; 240 v., ½ H.P., 3 H.P., 6 H.P.; 400 v., 2½ H.P., 3 H.P., 7½ H.P.; 480 v., 2 H.P., 3 H.P., 5 H.P., and several others.—E. P. ALLAM & Co., 107, Gray's Inn Road, W.C. 1. 9218

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts; also smaller sizes. Apply for lists.—CANNING & Co., Electro-Platers Engineers, Birmingham. 7769

ELECTRIC Furnace Plant, comprising 600 H.P. Slip-ring Motor, 2000 volts, 2-phase, 50 periods, 730 revs.; and 450 K.V.A. Generator, 110 volts, single-phase, 25 periods, with exciter and liquid starter. Will sell Motor or Generator separately if required. —BURY ELECTRICAL PLANT Co., LTD., Castle Grounds, Bury. 9203

FOR SALE.—*Continued.*

ELECTRIC Motors and Dynamos, Sale or Hire. Always a large stock of nearly new guaranteed machines. Immediate delivery.—ELECTRO-GENERATOR Co., 1A, Shepherd's Bush Road, W. 'Phone: 488 Hammersmith. 3567

ELECTRIC Motors, Starters and Switchgear; large selection, new and second-hand, in stock for immediate delivery.—MALCOLM & ALLAN, LTD., Kingsway House, Kingsway, London, W.C. 2; also at 499, Eglinton Street, Glasgow, and 17, North St. Andrew Street, Edinburgh. 3661

FOR Quick Sale: Two splendid Cornish Boilers, 7 ft. dia. by 32 ft. long, ⅜ in. plate, treble rivetted, longitudinal seams, corrugated flue, insured for 120 lbs. pressure. Very strongly constructed. Prompt delivery. £400 each. Copy of Insurance report on application.—FIRTH BLAKELEY, SONS & Co., LTD., Church Fenton, near Leeds. 3655

FOR Sale, cheap, an assortment of fancy and plain glass Electric Light shades.—ROYCE, LTD., Trafford Park, Manchester. 9206

FOR Sale, from stock, the following 2-phase, 220-volt, 42-period Motors, by Phœnix Dynamo Co., entirely new, all 1,200 revs., *i.e.*, one 5½-B.H.P., one 9-B.H.P., one 14-B.H.P., and one 15-B.H.P.; two bearing protected type; squirrel cage; with pulleys. Not yet left makers' works.—3646, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Generating Plant, comprising horizontal compound engine for 120 lb. steam pressure, driving by ropes a 150-KW., 500-volt, 425 R.P.M., multipolar compound-wound generator, by Crompton, with unused spare armature; can be inspected in South Wales.—PHŒNIX ELECTRICAL Co., 32—36, Broomielaw, Glasgow. 9298

FOR Sale, one Cinema Motor Generator. Make A.E.G. Motor 5 H.P., 440 volts, D.C., with starter, compound-wound, with interpole. Dynamo output, 50-60 amps., 70 volts, shunt-wound, excited from 440 supply, with interpole, shunt regulator. The two machines connected by flexible coupling and mounted on one bedplate. Complete. Only run six weeks. Only reasons for selling given up pictures for drama. Price £55 nett cash on L. & N.W. Rail at Leigh, Lancs.—Apply, THEATRE ROYAL, c/o Robert Bros., Silk Street, Leigh, Lancs. 3656

FOR Sale or Hire, high-class Dynamos, Motors, Alternators, Cable and Arc Lamps.—PERCY HUDDLESTON & Co., 72, Finsbury Pavement, E.C. 3643

FOR Sale, Rotary Converter (primary, 500 volts, D.C.; secondary, 350 volts, single-phase, 24 KW.), with transformer, &c., £110. —PHŒNIX Co., 32—36, Broomielaw, Glasgow. 9299

FOR Sale, six 10-H.P. three-phase, 400 volts, 50 periods, 720 R.P.M., complete with pulleys and drum-type starters; 10, 20 and 30-H.P. ditto. 10, 20 and 30-H.P. two-phase, 200 volts, 50 periods. D.C., 6-H.P., 100 volts. 8-H.P. and 10-H.P., 230 volts, 15-H.P., 460 volts. All complete with starters, slide rails and pulleys, ready to be put to work. Triple-pole Switches and Fuses, 50, 100 and 200 amperes.—Apply MACHINERY, Bradford Street, Walsall. 9252

FOR Sale, two 25-KW., 500-volt, 4-pole Generators, Bruce Peebles; one Scott & Mountain Set, with Bruce Peebles generator, 220 volts, 220 amps., 450 revs., 4-pole, interpole, compound, steam pressure 80 lbs.; one 15-H.P., 500-volt, 800 revs., Haulage Motor, 4-pole, shunt-wound; one ditto, series wound; six Motors, 9 H.P., 500 volts, 600 revs., 2-pole, shunt-wound, enclosed, Greenwood and Batley. All the above are for direct current. Immediate delivery. Offers wanted.—3645, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, two 1400-KW. Engines and Alternators, 50 cycles; two 55-KW. Willans-Laurence-Scott bi-polar Dynamos, complete with ejector condensers. Immediate delivery. Low price. —3611, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Uno Coffee Mill and Electric Motor, ¼-H.P., 230 volts, 1,500 revs., perfect order.—3608, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 35-H.P., 500-volt, 650 R.P.M., D.C. Motor and starter, £100. Also 40-H.P., 530-volt, 700 R.P.M., compound wound, intermittent rated Motor, £80.—PHŒNIX Co., 32—36, Broomielaw, Glasgow. 9296

FOR Sale, 70-KW. shunt wound, 4-pole interpole Generator, 470 volts at 820 R.P.M. Suitable for use as a motor or generator at any voltage between 460 and 570; also shunt regulator for same.—Offers for same to be addressed to H. P. STOKES, Electricity and Tramways Offices, Broadway, Bexleyheath. 9328

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, 150-H.P., 500-volt, 120 R.P.M., shunt interpole Motor. Cheap.—PHŒNIX Co., 32—36, Broomielaw, Glasgow. 9297

FOR Sale, 175-H.P. 500-volt, 50-cycle, 300 R.P.M., 3-phase, slip-ring type Motor, with liquid starter. Cheap.—PHŒNIX Co., 32—36, Broomielaw, Glasgow. 9295

ONE 9-KW., interpolar, shunt-wound generator, 230 volts, with pulley. Maker, Swedish General Electric Co. Only run one month. Condition new. £60.—ARTHUR SHAW, 49, Larkhill, Blackburn. 3629

STEAM Generating Sets for Sale.—One 200-KW. Willans-Mather and Platt, 220 volts or 440 volts; two 375-KW. Willans-Siemens, 460/550 volts, D.C., engines triple expansion; one electric capstan, 31 B.H.P., 500 volts, D.C motor.—JENNINGS, West Walls, Newcastle-on-Tyne. 8767

THREE Gross 210-volt, 8 and 16-C.P. Carbon Lamps. What offers?—3652, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TWO 75-KW. D.C. Generators (two), by Westinghouse, multipolar Type, 450/500 volts, 350 revs. per minute.—HARRY H. GARDAM AND CO., LTD., Staines. 8964

TWO 100-KW. steam-driven Generating Sets, by Laurence, Scott, 460 volts, with slip rings for lighting, together with two Lancashire Boilers, 28 ft. × 6 ft. 6 in., 160 lb. pressure, superheaters, pipe connections, all new 1912, in use two years.—SHAW, GASKELL, Hull. 3622

VACUUM Cleaner "Magic" for Sale, second hand, splendid condition, 250-volt, complete with accessories. Also new "Credenda" 2-link Electric Oven for 250 volts.—Full particulars on application to 3557, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

4·5-H.P., 200-volt, single-phase, 50-cycle Motor, by Langdon-Davies, speed 1450; also brand new 1·5-H.P. ditto, by Brooks, with starter.—DRUMMOND & Co., Middlesbrough. 3653

6-H.P., 440-volt, totally-enclosed, Hoist Motor, shunt-wound with series starting winding. Two-hour rating, in perfectly new condition.—DRUMMOND & Co., Middlesbrough. 3668

7-H.P. Motor, 480/530 volts, D.C., 660 revs., with starter, pulley, rails; circuit breaker by Westinghouse, new condition.—SUGDEN, Wakering Road, Barking. 3635

11-H.P., 220-volt, totally-enclosed, series Crane Motor, speed 400, also controller if required.—DRUMMOND & Co., Middlesbrough. 3667

45-KW., 440-volt, compound protected Dynamo, with spare armature, by Morley Engineering Co.; new condition.—DRUMMOND & Co., Middlesbrough. 3669

50-H.P., 220-volt, series Crane Motor; totally-enclosed by Westinghouse. Perfect order.—DRUMMOND & Co., Middlesbrough. 3670

65-KW., 440/500-volt, shunt-wound Multipolar Generator, speed 575; in perfect condition and ready for use.—DRUMMOND AND Co., Middlesbrough. 3672

100 STATIC Electric Gas Lighters, 7s. each. 2,000 ft. case and cap, extra strong, 2½", 12s. per 100 ft. (20 feets). Opal shades, 9" cases, 8d.; 8" cases, 7d.; 5" saucers, 5d. C.C.C. wire, 22s., 1s. 6d. per lb.; 30s., 2s. 2d., and intermediate sizes. Large seamless steel tube, 18's gauge, 1¼", 5d.; 1½", 6½d.; 2", 9d. per foot. Edison screw D.P. cut-outs, 1s. 6d. each. Plugs, 3d. each.—DUGDILL'S, Failsworth, Manchester. 9224

150-KW., 500/600-volt, 6-pole compound-wound Generator, by Holmes, speed 450, with two bearings and half coupling, for coupling direct to engine, or could be arranged for belt drive. Perfect working order.—DRUMMOND & Co., Middlesbrough. 3671

172-KW. Generating Set, Paul-Mavor & Coulson, 220 volts, D.C.; 172-KW. Generating Set, Paul-Crompton, 500 volts, D.C.; 150-KW. Generating Set, Anderston Foundry-Mavor, 250 volts, D.C.; 150-KW. Generating Set, Alley & M'Lellan-Mavor, 220 volts, D.C.—Price and particulars from ROBERT WALKER, 2, Oswald Street, Glasgow. 8801

220-VOLT Electric Drill, by Campbell & Isherwood, on portable barrow, complete with adjustable shaft and drill holder; perfect condition.—Apply DRUMMOND & Co., Commercial Street, Middlesbrough. 3673

300-KW. Alternator by Brush Company, 6500 volts, 50 cycles, 3-phase; new 1912; in use few months only.—HARRY H. GARDAM & Co., LTD., Staines. 8658

ARTICLES WANTED.

WANTED TO HIRE.

ONE Motor-Generator Set, 3-phase, 400-volt, 50-period motor driving D.C. dynamo, 75 volts, 50 amperes.—Apply, stating terms, to—

CITY ELECTRICAL ENGINEER,
Carlisle. 9313

ELECTRICAL ACCESSORIES WANTED.

SPOT cash for Electrical Accessories.

Please state your offers to

3658, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone: Dalston, 555. Telegrams: Secondhand, Lowclap, London. Established 1860. 2092

A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 3632

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 3633

ACCUMULATOR Battery wanted, 36-hour, 100-volt, 30 to 40-ampere.—ROBERT SEMPLE, 179, West George Street, Glasgow. 9329

ALL for Munition purposes.—Obsolete Motors, Dynamos, Insulated Cable, and every description of Electrical Plant bought to break up. Send us your stocks of scrap metals.—G. H. CHAPPELL SONS & Co., Midland Wharves, Lea Bridge Road, Leyton, N.E. 'Phone:—Walthamstow 500. Estab. 40 years. 3565

ARC Lamp Carbons wanted, all sizes. State quantity, dimensions and lowest price.—3558, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 3393

INCANDESCENT Lamp-Making Apparatus, all kinds; Piecing-Pinching, Stud-making, Sealing-in, Flange Machines; Winding, Flashing, Photometer, Testing, Vacuum Apparatus; Gaede and rough Vacuum Pumps, &c., &c.—Full particulars, price, 3604, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OLD Electric Lamps with glass intact.—104, Craven Park, London, N.W. 10. 3306

PLATING Dynamo wanted, large size, and 220 or 440 motor to drive same.—3580, ELECTRICAL REVIEW 4, Ludgate Hill, London.

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road London

PLATINUM Scrap purchased in large or small quantities, Highest market value given.—Before selling elsewhere call or post to the old and reliable firm, THE DEPÔT, 156, Charing Cross Road, London. Established 1850. 3674

SHUNT-wound Dynamo, 50/70 volts, 15/25 amps.; also twin Flex.—105, Loyd Road, Northampton. 3654

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—3133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, any quantity old Armoured Cable, also obsolete Plant.—COATES, Fenay Bridge, Huddersfield. 3605

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

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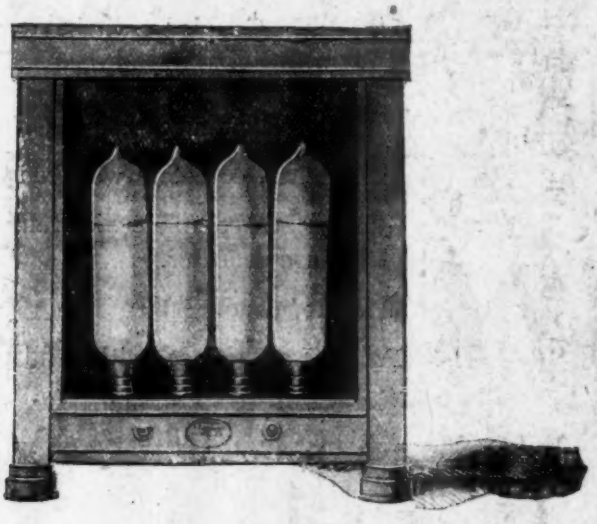

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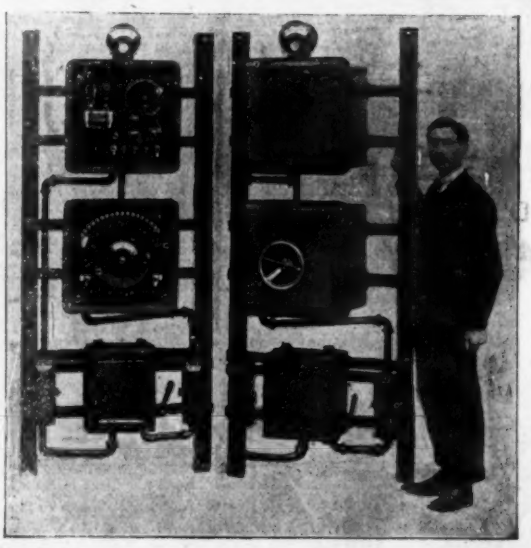

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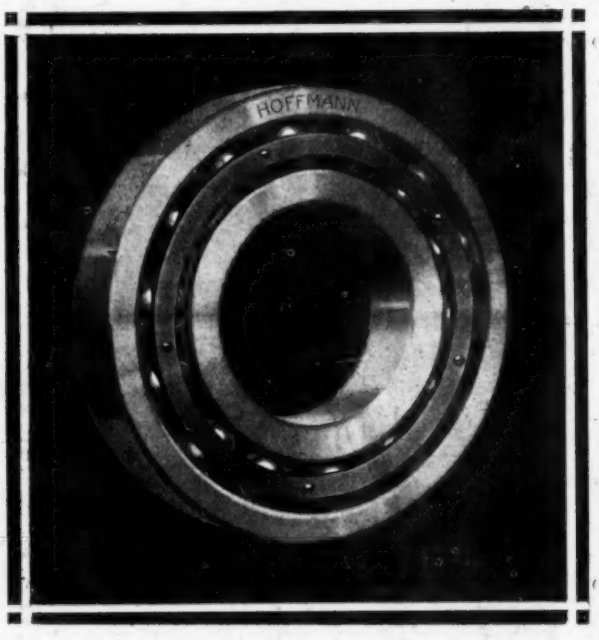

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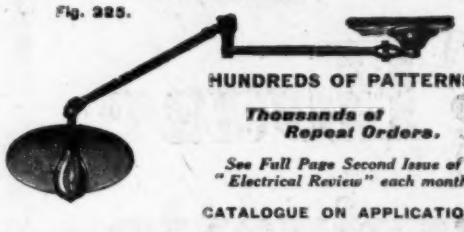

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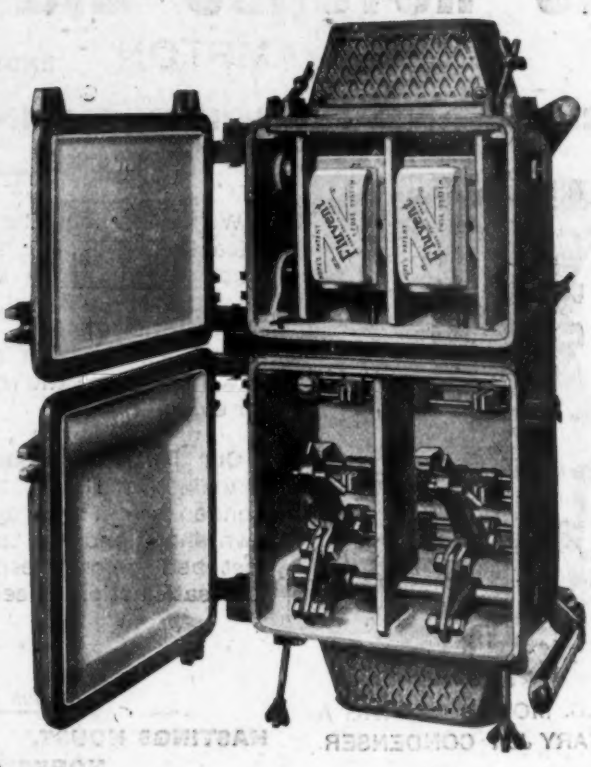

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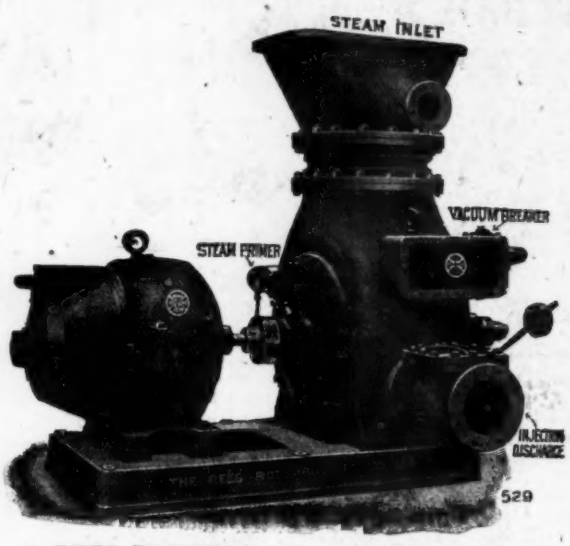

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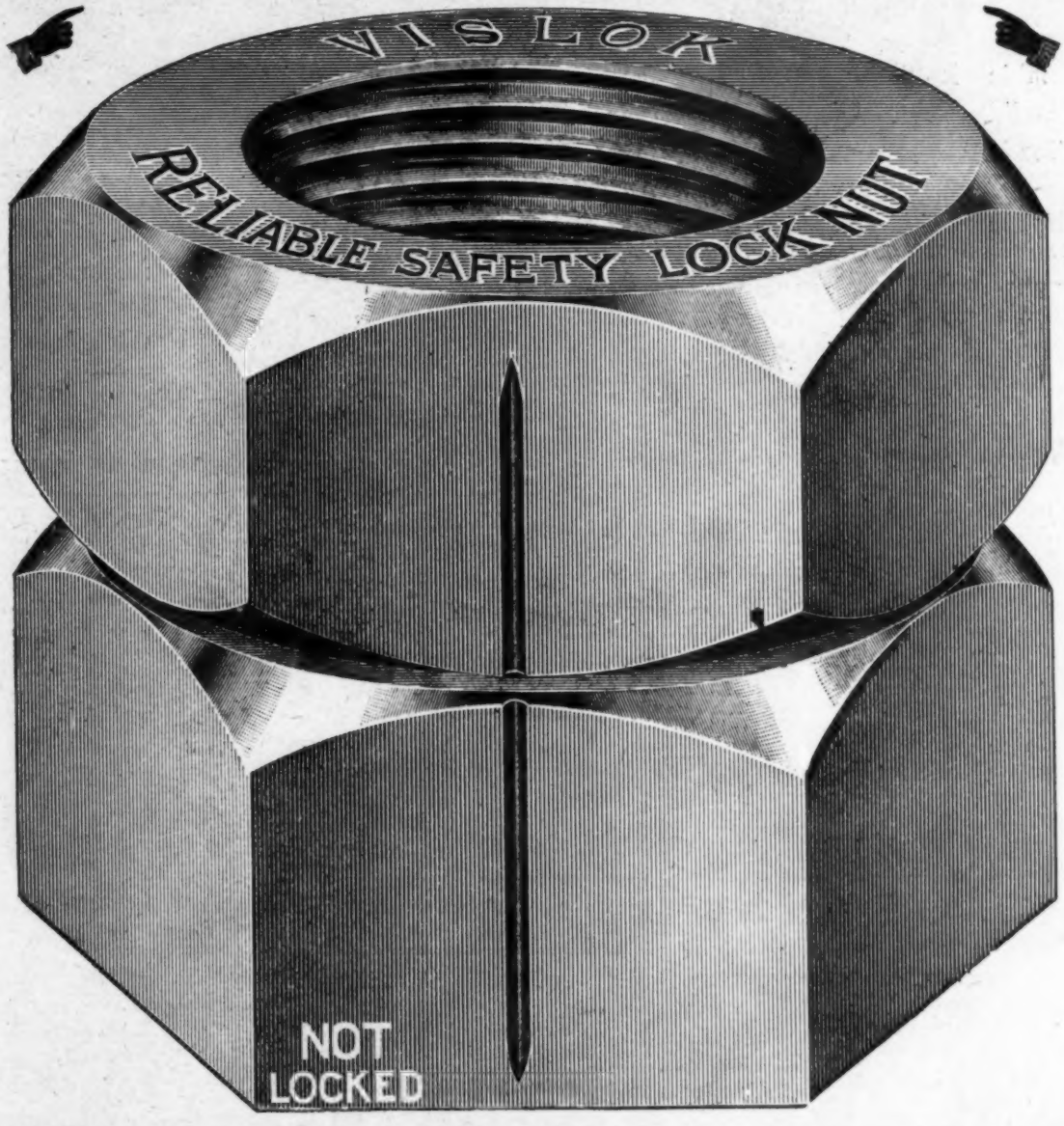

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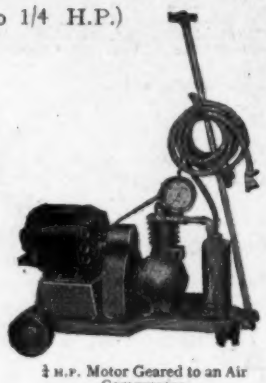

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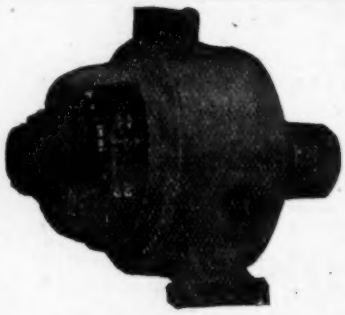

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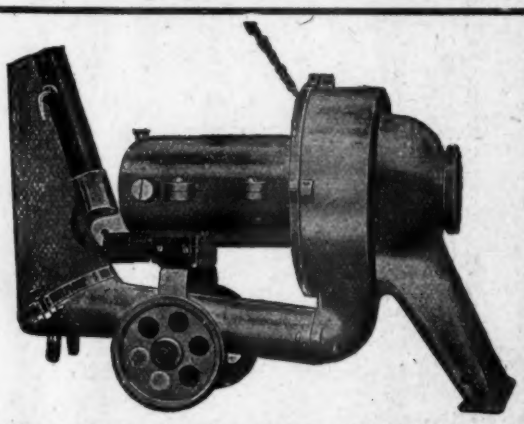

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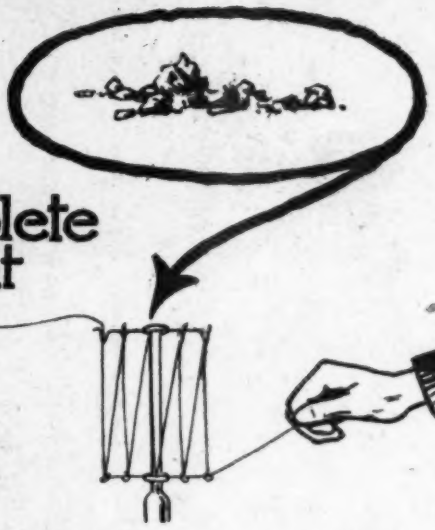

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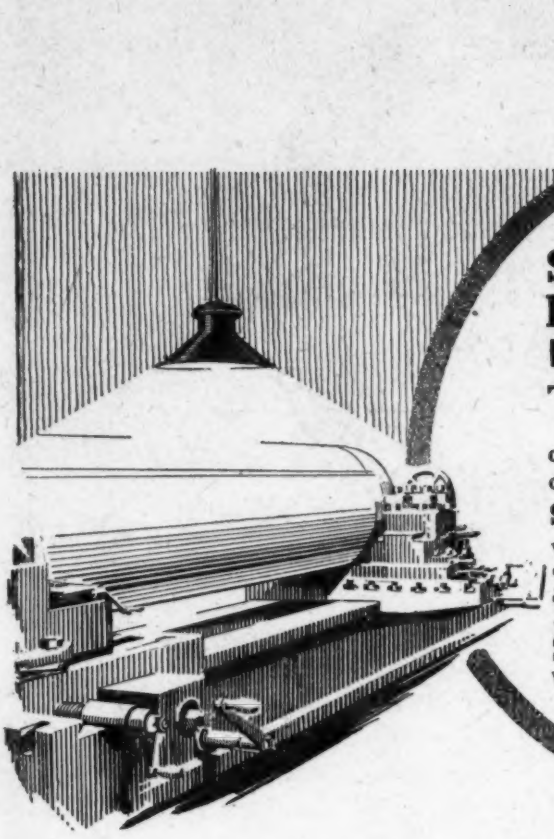

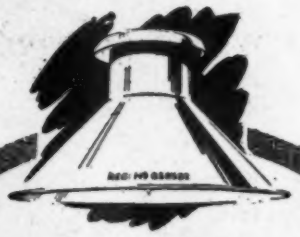

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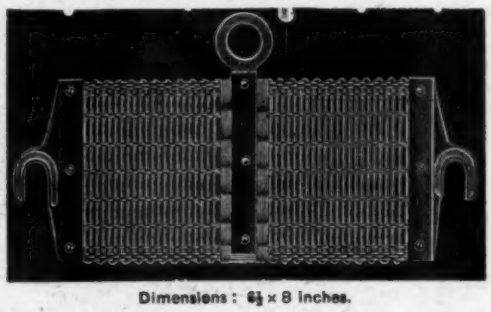

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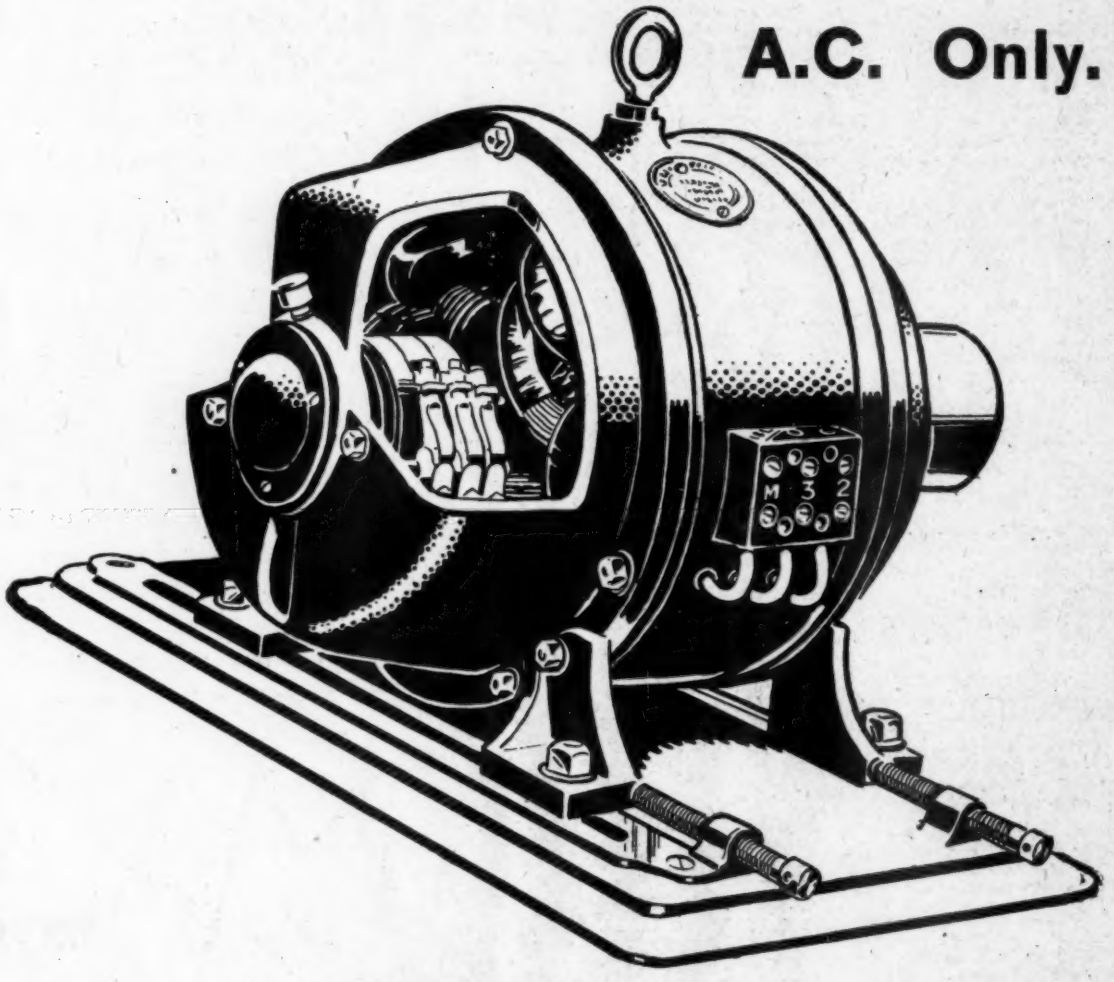

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"About a month ago I came across a technical term I had not seen used before. Being anxious to satisfy myself of the exact meaning, I spent two hours in the reference library looking over many works without finding it. You can judge of my surprise when looking over your Diary, almost the first thing my eye alighted on was the very term I had been looking for."—A. E. SEGNITZ, Electrical Engineer, 206, Westminster Road, Handsworth, Birmingham.

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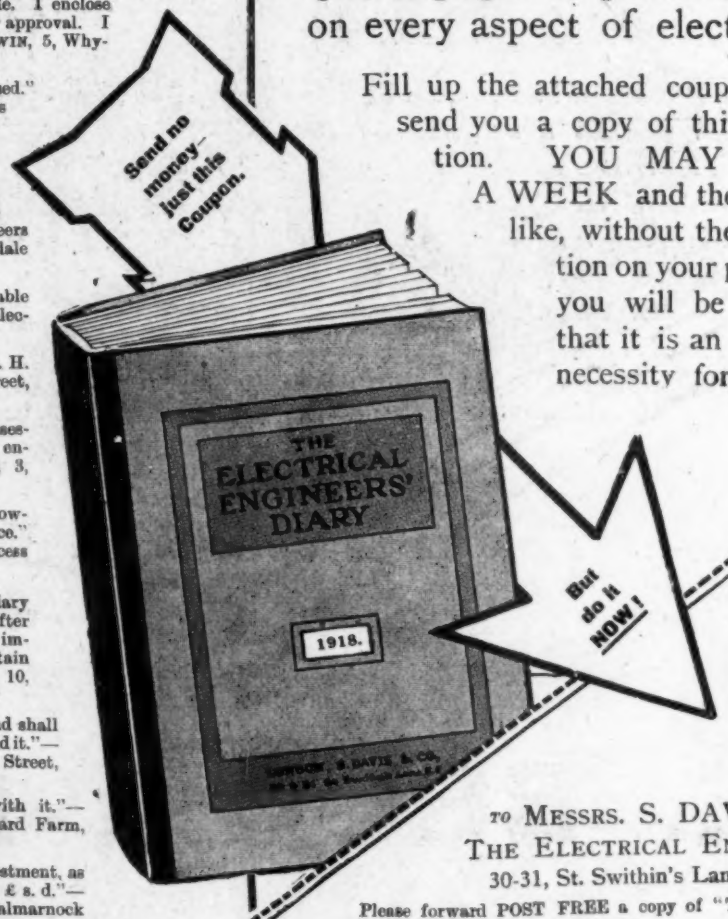
Extracts from other letters were printed last week and a further selection will appear next week.



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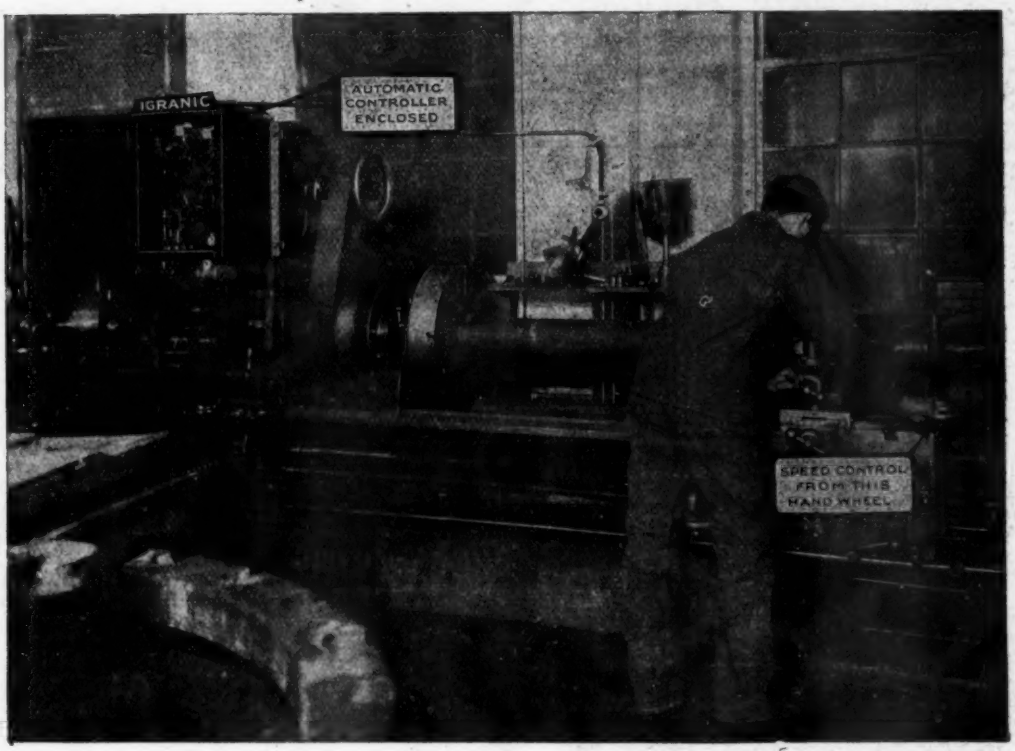

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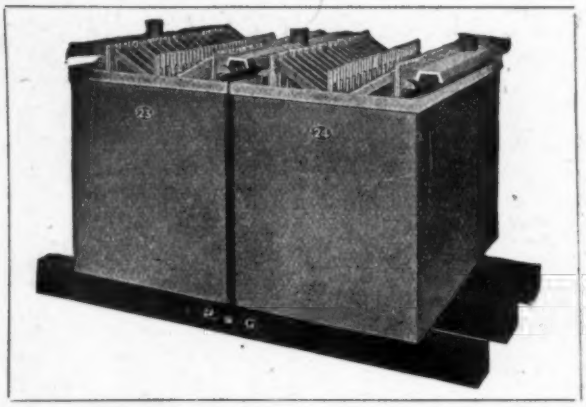

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But conclusively, comprehensively, and several times and again.
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We have had a jolly good lesson, and it serves us jolly well right.

* * * *

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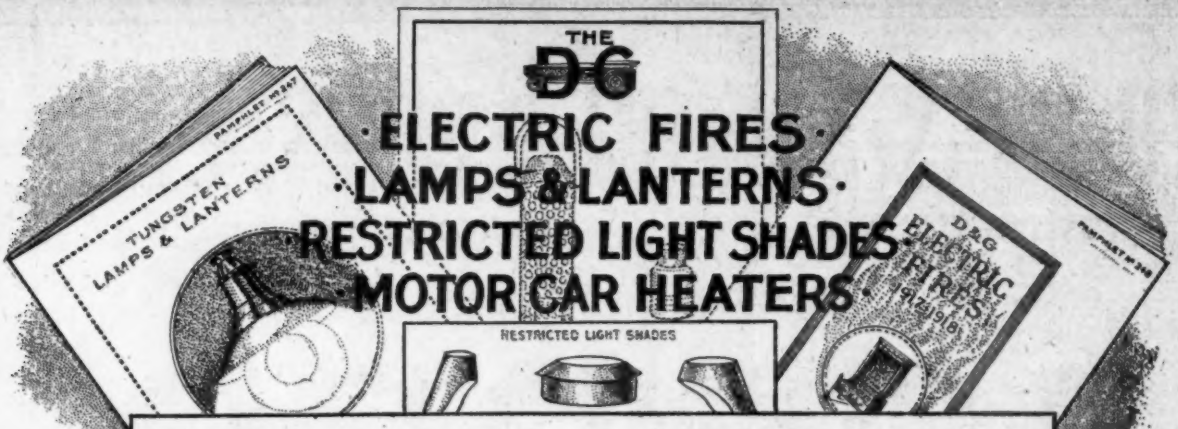

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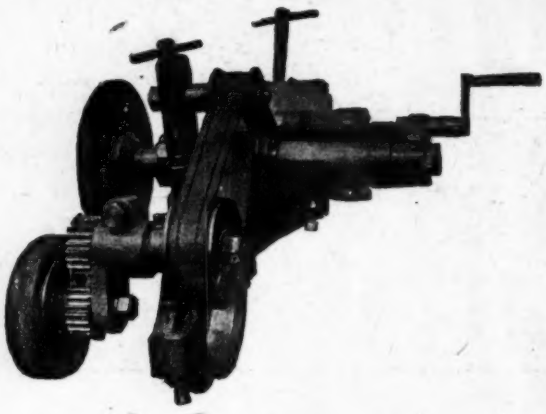

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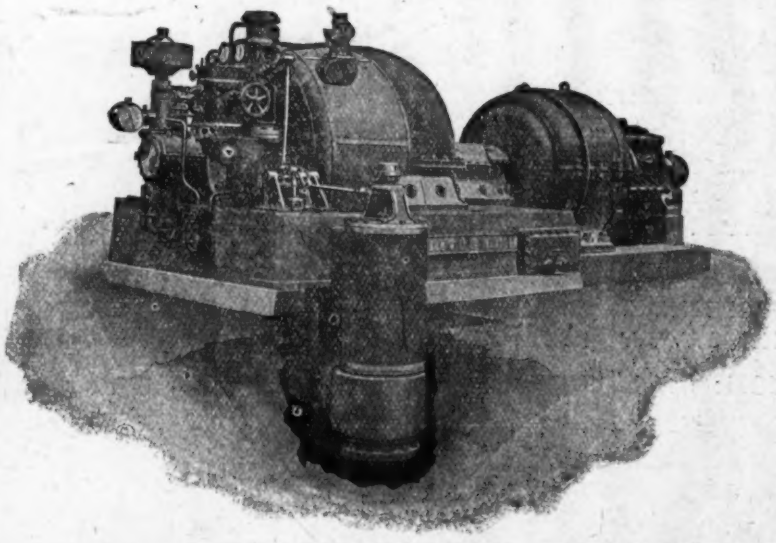

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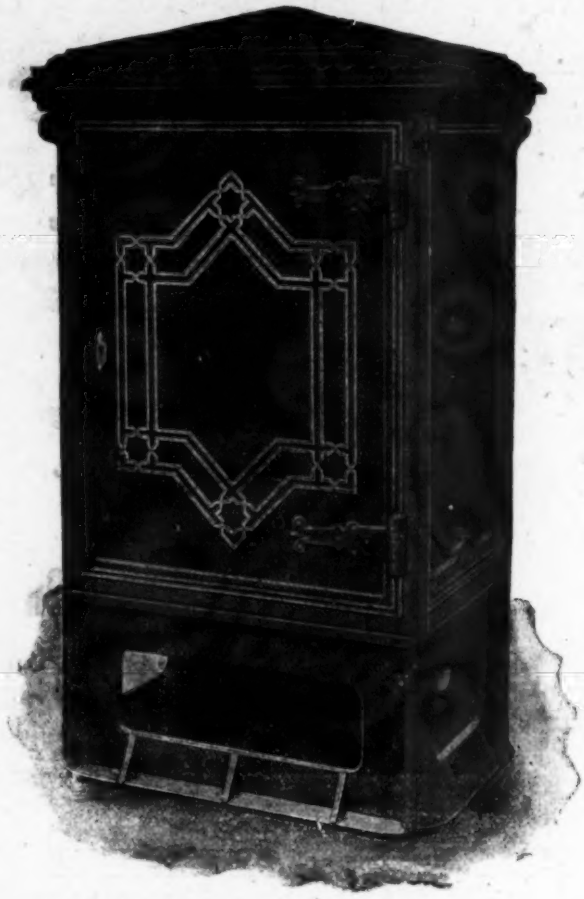

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„ 1b ...	21 × 12 ins. ...	33 × 17 ins.
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„ 2a ...	21 × 16 ins. ...	33 × 17 ins.
„ 2c ...	21 × 18 ins. ...	33 × 17 ins.
„ 2b ...	25 × 14 ins. ...	36 × 21 ins.
„ 3 ...	25 × 16 ins. ...	36 × 21 ins.
„ 3a ...	25 × 20 ins. ...	36 × 21 ins.
„ 3b ...	31 × 16 ins. ...	36 × 27 ins.
„ 4 ...	31 × 20 ins. ...	36 × 27 ins.
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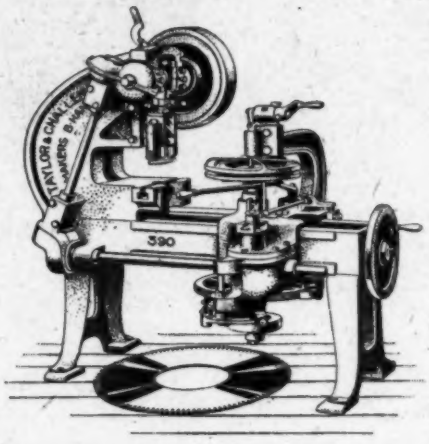

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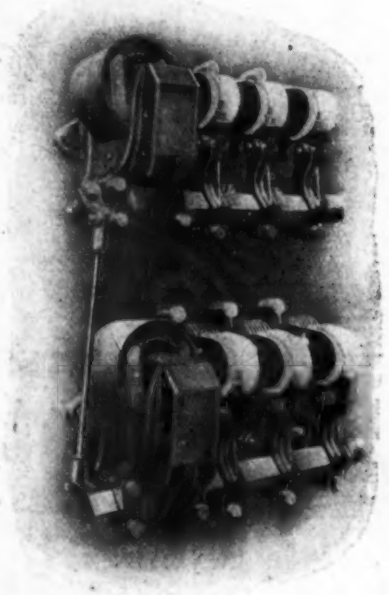

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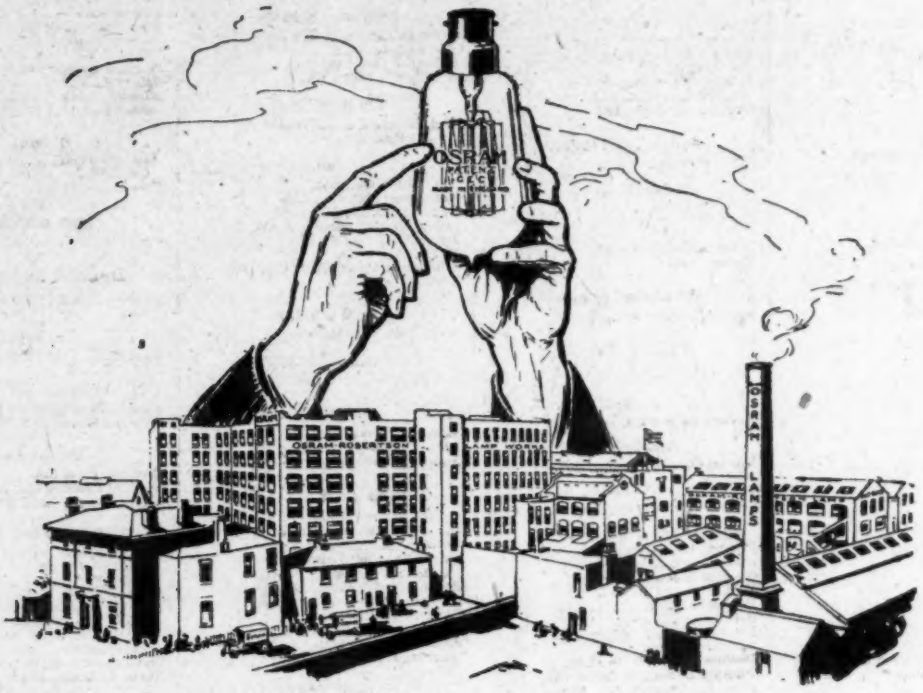

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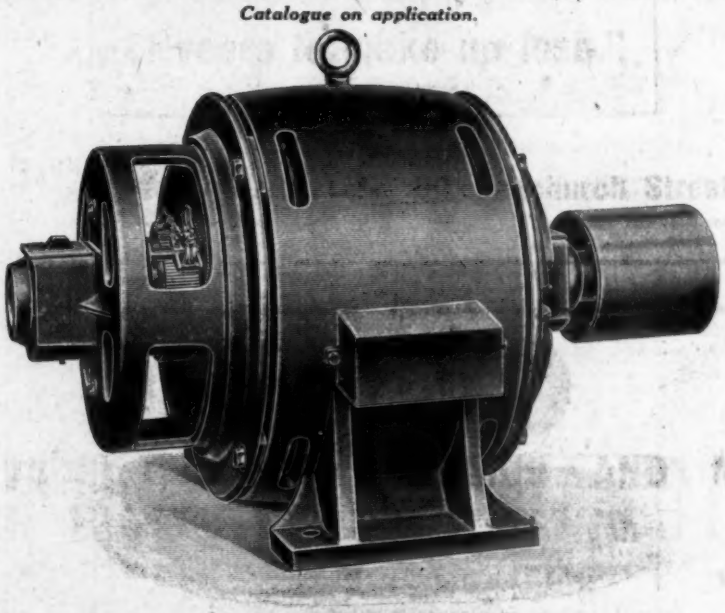

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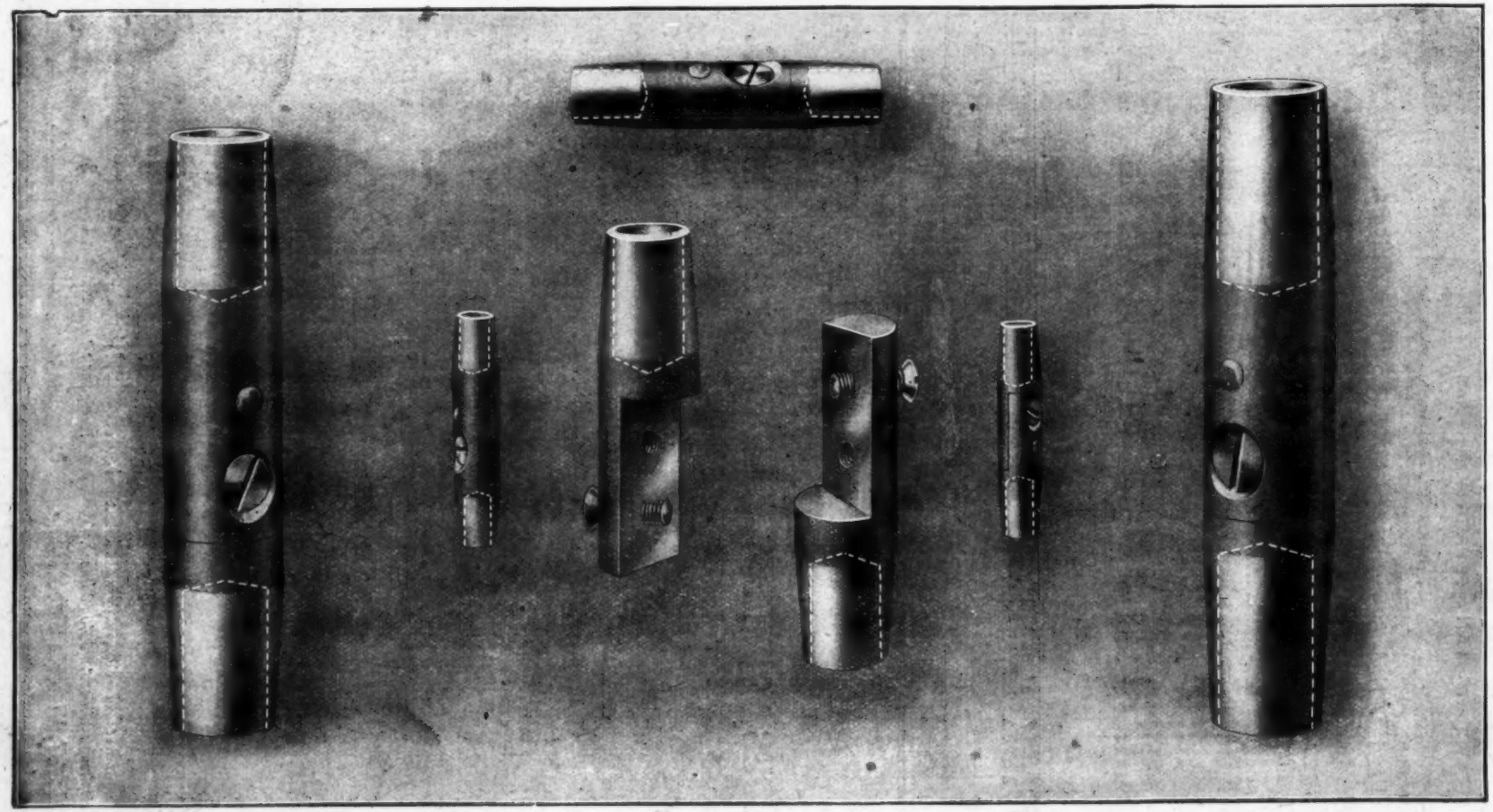

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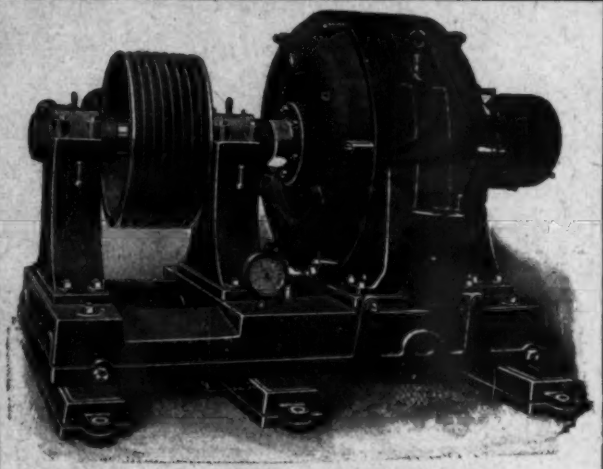

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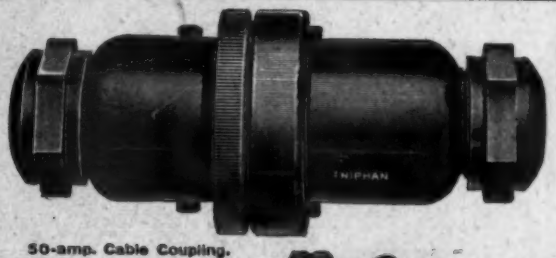

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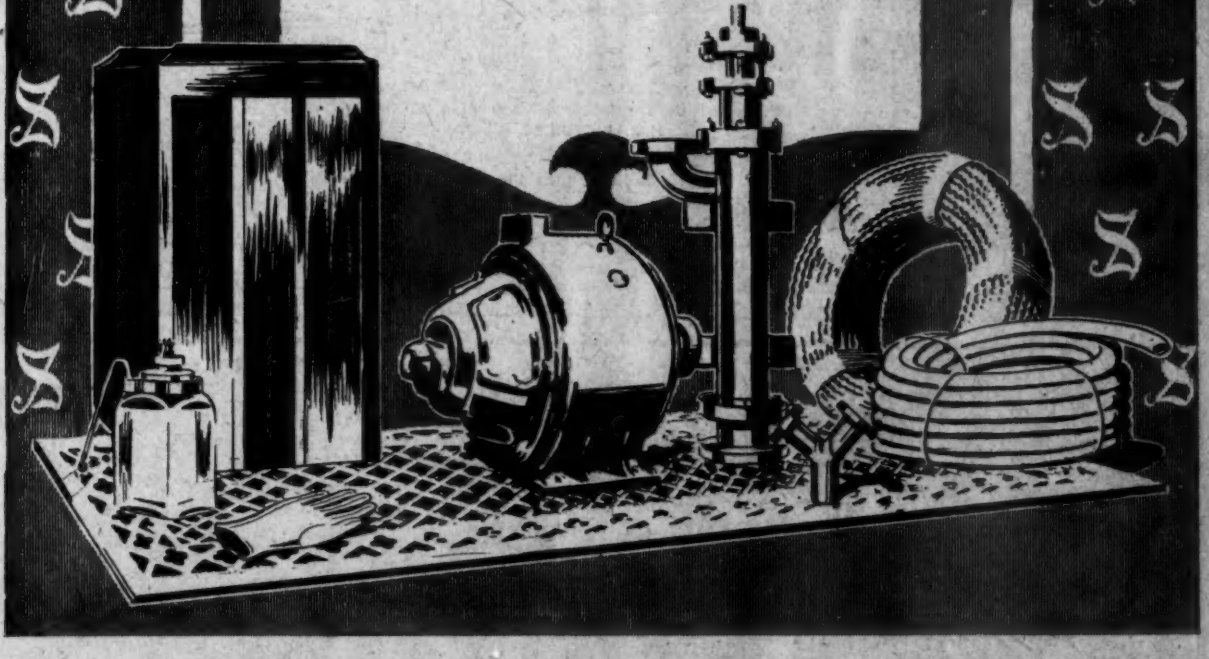

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